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AIR AS A CONDENSING MEDIUM

IN OUR ISSUE OF Practical Engineer for February, 1909, attention was called to a novel proposition advanced by E. J. Christie as to the effect of mixing air with steam when expanding it in the cylinder of an engine. It was there shown that the air will cool much more rapidly than the steam and will, therefore, extract heat from the steam during expansion and by its own expansion will transform this heat into work more rapidly than the steam can do in expanding. There is, therefore, a double action between the steam and the air. The air takes up heat from the steam, thus acting in the same manner as a condenser would do, while the steam reheats the air, thus increasing the amount of work that it can do during expansion.

In that article it was shown that, taking steam and air at 150 lb. pressure and a temperature of 358 deg. and expanding it 4.8 times, the final pressure of the steam would be 25 lb. and its temperature 240 deg., while the final pressure of the air would be 16.4 lb. and its temperature —30 degrees. Some experiments have been carried on in England with a locomotive engine working on this basis, and also experiments were carried on by Mr. Christie on a small vertical air engine. Another advantage of the use of air in this way is that it increases the possible efficiency of the steam cycle. Rankin's law that the heat efficiency depends on the ratio of the difference between the highest and the lowest temperatures to the absolute temperature at the lowest point, shows us that as we decrease this lowest temperature we are increasing the efficiency of the engine during expansion.

In the case of the steam engine working non-condensing and exhausting into the atmosphere, the low temperature will be 212 deg. F., or slightly above. When air is mixed with the steam, the mixture on expanding falls to a temperature much lower than this, thus converting a larger part of the heat energy into work before it is exhausted to the air.

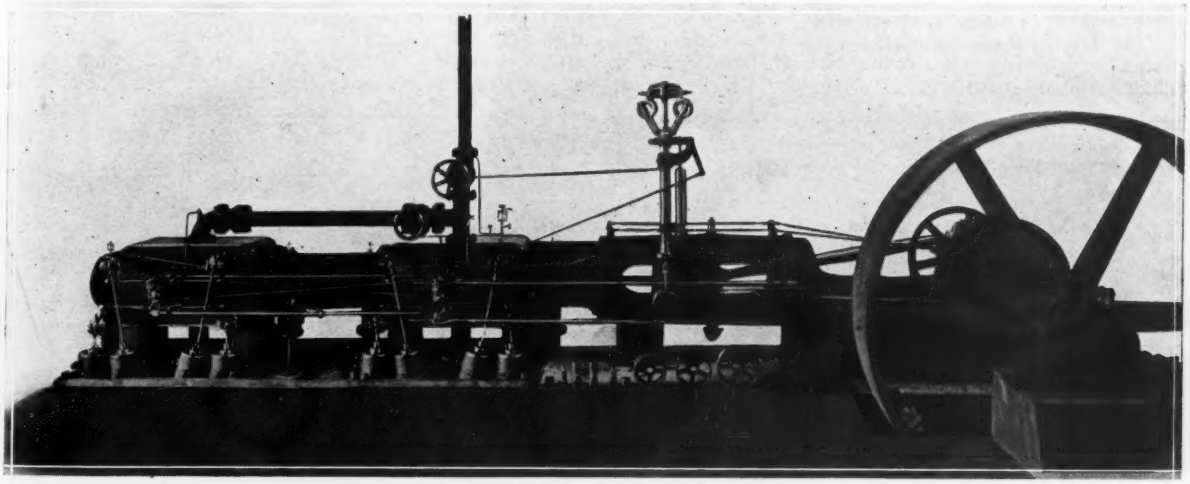


FIG. I. THE CHRISTIE AIR-STEAM ENGINE ON THE FACTORY FLOOR

Strong in the faith that he was correct in his proposition, Mr. Christie has organized the Christie Engine Co. and this company has had built a 300-hp. Corliss engine to operate on the 4-stroke cycle.

Cycle of Operation

THE operation during the strokes is as shown in Fig. 2. On the first stroke one of the cylinders will be compressing air with steam on the other side of the piston, while the second cylinder of the two

in tandem will be drawing in air on one side and exhausting the mixture of steam and air on the other side. On the second stroke the air which has been drawn into the right-hand cylinder will be compressed while the steam and air which were working in the left-hand cylinder are exhausted from the crank side

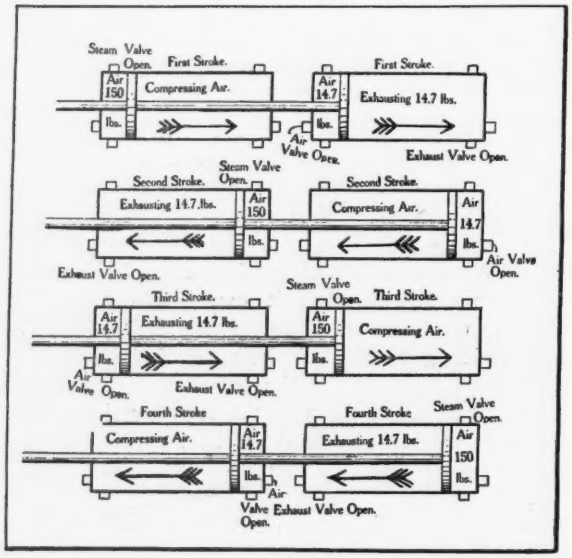


FIG. 2. ACTION OF 4-STROKE CYCLE

of the piston and the steam-air mixture on the head end side of the left-hand cylinder are expanding, doing work. At the same time the head end of the right-hand cylinder is drawing in a charge of air.

On the third stroke the right-hand cylinder becomes the working cylinder and the left-hand cylinder exhausts on one end and draws in the air charge on the other. On the 4th stroke the right-hand cylinder is still the working cylinder, the work being done on the head end and the mixture exhausted from the crank end, while the left-hand cylinder is compressing air on the crank end and drawing in air on the head end. The cycle is then repeated, starting with the first stroke.

In any one cylinder the cycle of operations is similar to that for a 4-stroke cycle gas engine. On the first stroke air is drawn in, on the second stroke it is compressed, on the third stroke steam is admitted and the mixture of air and steam expands, and on the fourth stroke the expanded mixture is driven out of the cylinder. This is indicated on Fig. 3, the line IJ representing the pressure at which air is drawn in, the line OB the compression line for the air, BC the admission line for steam, CN the expansion line for the air and steam mixture, after which the pressure drops and the mixture is exhausted along the line OS.

It will be noted that there is an unusually large clearance allowed, represented by the distance AB in the diagram Fig. 3. This is necessary in order to avoid over-compression of the air, since the cylinder full of air at atmospheric pressure must be compressed into the clearance space, and it is not desirable to compress the air above the pressure of the incoming steam.

It is important to consider Dalton's 2 laws in regard to vapor tension in examining the action of this engine. The first law is: "The pressure and consequently the quantity of vapor which saturates a given space are the same for the same temperature, whether the space contains a gas or is a vacuum." This means that a given space will take up the same amount of steam, whether the space is empty or is occupied by a gas. The second law is: "The pressure of a mixture of gas and vapor is equal to the sum of the pressures which each would possess if it occupied the same space alone."

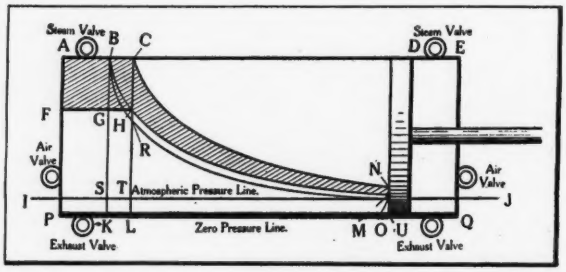


FIG. 3. THEORETICAL AIR-STEAM DIAGRAM AND ACTION IN ONE CYLINDER

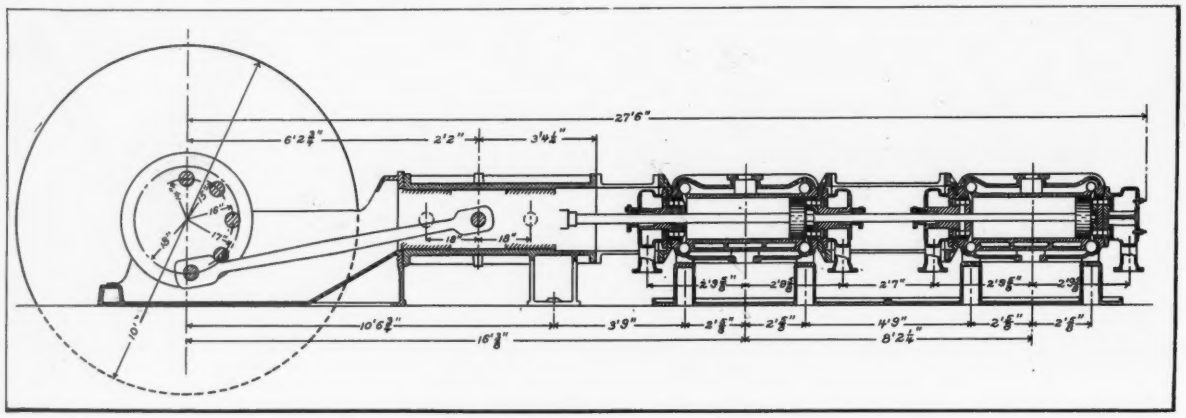


FIG. 4. SECTION OF TANDEM CHRISTIE ENGINE

In the action of the engine there are certain points that cannot be determined without considerable experimentation. In the first place, the air as it is compressed is not a perfect gas, but is a gas containing a large amount of water vapor. This is due to 2 things, first that the clearance space, when admission opens for the air, is filled with a mixture of steam and air; in the second place there is a good deal of moisture in the cylinder at that time, due to the condensation

of the steam during the expansion stroke. As the air is compressed and the temperature, therefore, rises, this moisture will be first of all converted into steam and then perhaps superheated, depending on the amount of temperature rise of the air and the proportions of air and moisture.

The advantage of reheating compressed air in using it as a motive fluid is well known. The advantage of working steam condensing is well known. The objection to working condensing in the single cylinder, viz., the increase of initial condensation because of the high temperature range, is overcome if the cylinder walls are again brought to the high temperature of the incoming steam before admission takes place. In the case of the air compression, by a right porportioning of air to steam, this can be accomplished.

Construction Details

GENERAL proportions of the engine as built are shown in Fig. 4. On the ends of each cylinder are air heads connected to common inlet pipe which runs outdoors. Admission of air is accomplished by means of poppet valves closed by a spring exactly the same as in an air compressor, and opening inward, due to the suction in the cylinder on the air intake stroke. Admission of steam and the exhaust of the mixture of steam and air are controlled by Corliss

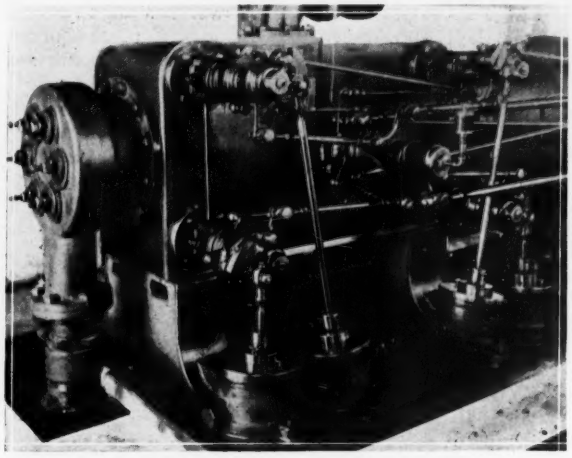


FIG. 5. THE VALVE GEAR OF THE AIR-STEAM ENGINE

valves of the regular type used in its engine by the Vilter Mfg. Co., of Milwaukee, Wis., which constructed the present engine.

Two special features are provided in the valve gear, as shown in Figs. 1, 5 and 6. In the first place the exhaust valves are driven by catch blocks and closed by dashpots, the same as the steam valves. In the second place, intercepting cams are introduced on both steam and exhaust valves, these cams being controlled by eccentrics on an intermediate shaft, which shaft is driven at half the speed of the engine proper by a pair of gears seen in Fig. 1, just back of the flywheel.

The intercepting cams are mounted on the valve bonnets and operate the same as a safety trip to hold up the latch block on each valve every other revolution, so that the steam and exhaust valves on each cylinder are inoperative every other revolution, giving the air inlet valves in the air heads a chance to operate during the suction stroke and permitting of compression during the compression stroke. The disconnecting mechanism for both steam and exhaust valve is of the regular Vilter type described in the May issue, and the governor is of the special design used on the heavy duty type Vilter engines and has the regular safety features.

As the engine under discussion is built particularly for experimental determination of the method of action of the air-steam mixture, 3 governor pulleys have been provided so that the engine may run at 80, 100 and 120 r. p. m. Also, as indicated on Fig. 4, the crank disk is arranged so that the stroke of the engine may be altered to change the clearance, and

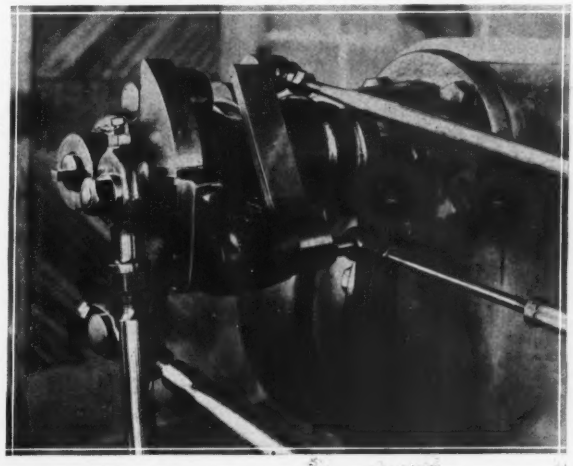


FIG. 6. STEAM VALVE BONNET SHOWING THE INTERCEPTING CAM

false heads have been provided so that the clearance may be changed in the cylinder without altering the stroke.

Data So Far Obtained.

UP to the time of writing it has not been possible to load down the engine, so that the only data and diagrams available are those taken under friction load.

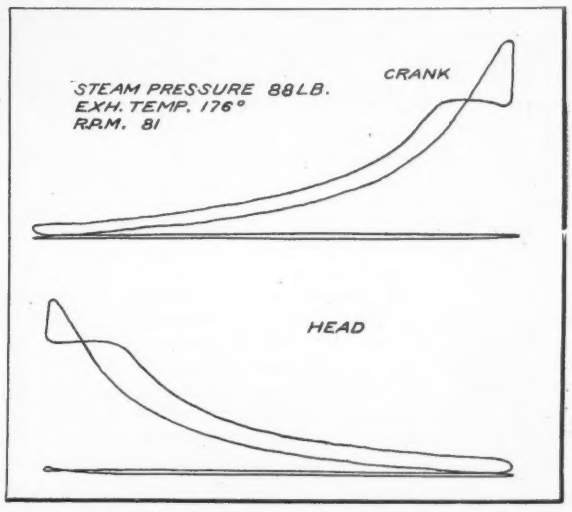


FIG. 7. DIAGRAMS FROM AIR-STEAM ENGINE

A set of diagrams is shown herewith taken under these conditions, the steam pressure of the boiler being about 90 lb. and the engine running at 81 r. p. m. Temperature observations taken on the steam coming from the exhaust pipe showed 176 deg. Fahrenheit,

and the water was running from the exhaust pipe in a small stream, while the steam exhausted was very moist.

As set at this time, the engine had 12 per cent clearance, which would give a compression ratio between full stroke and clearance volume of 9.35. Measuring from the diagram, the ratio of pressures on the crank end card is 9.4 and on the head end card is 8.35, the difference being due to a difference in clearance volumes. The temperature of steam at exhaust shows clearly enough the condenser action of the air when expanding with the steam and the statement was made by Mr. Christie that this temperature becomes less as the steam pressure is raised, which is explained by the fact that the cut-off becomes shorter with higher steam pressure, therefore the expansion of the steam and air is greater.

The engine operates smoothly, the only notable difference between it and the all-steam engine being the absence of the dashpot action on the steam valves

FIG. 8. VIEW OF CHRISTIE ENGINE FROM SHAFT END

every other revolution. The action of the air inlet and compression, which runs up to about 120 lb. and was intended for operation with steam at 120 lb. pressure, and of the inlet of steam and the expansion of the mixture with the following exhaust are clearly shown on the diagrams. What the temperature of the air at the end of compression may be it is not possible to determine without further experimenting. What the right proportion of air to steam for the most satisfactory operation may be can only be determined by experiment.

Steam exhausts at 176 deg., which corresponds to 7 lb. absolute pressure or a vacuum of about 15.5 in. The gain in theoretical heat efficiency starting with steam at 90 lb. pressure will be found as follows:

The temperature corresponding to 90 lb. gage would be 331 deg. Using the ordinary expansion noncondensing, the exhaust temperature would be 213 deg. or a difference of 118 deg. This is to be divided by the absolute temperature corresponding to 213 deg., which would be 213+461 or 674 deg., giving a possible heat efficiency of 17.5 per cent.

Bringing the exhaust temperature down to 176 deg. makes the temperature range 331—176, or 155 deg., and the possible heat efficiency would, therefore, be 155÷637, or 24.4 per cent.

It should be remembered that the engine is here running under very unfavorable conditions. In the first place the steam pressure is entirely too low for satisfactory operation; in the second place the air compression is not adjusted for the steam pressure at which the engine is running; in the third place the engine is running with no load, which makes the proportion of steam to air altogether too small for satisfactory working. What the system will show under load is a matter of conjecture.

As with all new machinery, a certain amount of tuning up and experimenting must be gone through with to determine and secure the best operating conditions, and after that load tests must be run to find out what the exact saving in steam consumption is, but the data so far obtained correspond closely with the conditions figured out beforehand by the inventor and designer, and the outcome of further experiments will be watched for with great interest.

IN AN ADDRESS before the Southern Commercial Congress, George Westinghouse stated that there are estimated to be in the Appalachian Mountains from 5,000,000 to 7,000,000 horsepower in water power, which can be developed. This amount will be available in the dry season, and a much larger quantity at other times. This, if developed and utilized, would result in the saving of 25,000,000 tons of coal annually. If no water power was available, methods would be adopted for producing power and conserving heat which would effect a saving of over one-half the coal now consumed in the world.

Large development of water power has already taken place in the South, the Southern Power Company having a system which extends 150 miles north and south and 200 miles east and west, connecting into a single system, the plants aggregating 100,000 horsepower.

Besides furnishing light to 45 cities and towns, and supplying current to six street railway systems and to hundreds of power motors, electric current has been utilized for refining steel in the operation of the iron mines which are abundant in the South, and has been largely introduced for the driving of cotton mills.

Also a use which has been experimented with somewhat is reported by Sir Oliver Lodge in the Stimulation of Plant Growth by Electricity.

Tracts of some 20 acres each similarly sown or planted, one tract being excited by high tension electricity at about 100,000 volts supplied by a 2 hp. generating outfit, and the other one growing under natural conditions have shown an increase of 30 to 40 per cent in wheat crops and similar increase in the growing of vegetables and small fruits. This increase is explained by the fact that high frequency electrical discharges favorably effect the deposit of nitrogen in the atmosphere into the soil and thus contribute food for the plants.

Experiments have also shown that the use of the ultra-violet rays give a satisfactory sterilization of water and milk, milk so sterilized being kept in properly sterilized receptacles for a long period without deteriorating or losing in its food value. Experiments in Paris and at the City Water Works of Marseilles, France, have shown not only that sterilization is possible, but that a 15,000 kw. generator would furnish electrical energy to sterilize by the use of mercury vapor quartz lamps as much water as is used for drinking and cooking in the United States.

THE DARKEST HOUR in any man's career is that wherein he first fancies there is an easier way of gaining a dollar than by squarely earning it.—Horace Greeley.

A SCRIBER MADE from hard brass wire gives a fine light yellow mark on black metal surfaces such as stovepipe material, boiler plate, etc.—Popular Mechanics.

DETAILS OF POWER PLANT DESIGN V

ENGINES AND GENERATORS

By Charles L. Hubbard

ENGINES used in isolated plants of the kind under consideration are practically confined to the high speed and moderate-speed types, with a majority of the former in office buildings. Engines of these types, especially the high speed, are compact, taking a comparatively small amount of floor space, and are suitable for connecting directly with the generator, which is the universal practice at the present time.

Simple high-speed engines of the best make have an average steam consumption of 30 to 34 lbs. per indicated horsepower per hour, and the medium speed from 28 to 32 lb. When operating in connection with a heating system where the whole of the exhaust is utilized, the matter of economy does not figure prominently except in the summer time when the exhaust is thrown outboard.

When the heating season is short, it is often an advantage to use compound engines on the score of economy during the non-heating months. The local conditions in any particular case must be considered before deciding between the simple and compound types. The first cost of a compound engine is approximately 30 per cent in excess of a simple engine, while the expense of operation may be from 25 to 35 per cent less when operated within their economical range, which is between one-half and full load.

The greater economy of this type of engine is due in some measure to the reduced cylinder condensation, but more especially to the greater number of expansions and higher initial pressure. During the period of exhaust the entire internal surface of the cylinder is exposed to steam at exhaust pressure, and a layer of iron of greater or less thickness is reduced to a temperature approximately that of the exhaust steam. When steam at boiler pressure is admitted at the beginning of the succeeding stroke, a certain amount of heat is given up in raising the temperature of the cylinder walls to that of the inflowing steam. This results in the condensation of a given quantity of steam at each stroke, which is a dead loss, so far as useful work is concerned, but which must be included in the total amount supplied to the engine.

Cylinder condensation increases with the ratio of expansion, for the greater the difference between the initial and final temperatures of the steam, the greater will be the cooling effect on the cylinder between the exhaust and admission periods. The amount of heat in the steam which is actually converted into useful work is very small compared with that rejected in the exhaust and lost by radiation and condensation.

For example: 1 horsepower represents 33,000 foot pounds of work per minute; and the heat equivalent of this is $33{,}000 \div 778 = 42$ British thermal units per minute, or 2,520 per hour. The latent heat of steam at 100 lb. gage pressure is 876 B. t. u., or in other words, the available heat in $2520 \div 876 = 2.8$ lb. of steam, would be sufficient to generate 1 hp., if it could all be turned into useful work. Actually over 30 lb. are required in the average non-condensing simple engine, 0.9 of which is required to offset the heat carried off in the exhaust and dissipated in the various cylinder losses.

Cylinder condensation limits the pressure under which a simple engine can be operated economically, because after a certain point is reached these losses more than offset the gain in power. If, the same weight of steam is expanded through the same range of pressure in 2 cylinders, one exhausting into the other, instead of in a single cylinder, the resulting condensation will be considerably reduced.

Temperature Range in Cylinders

THIS may best be shown by a practical example: A simple, or single-cylinder engine, is supplied with steam at an initial pressure of 100 lb. gage pressure, and exhausts at a pressure of 2 lb. above the atmosphere. The range of temperature to which the interior of the cylinder is exposed is $337 - 219 = 118$ deg. Now, if 2 cylinders are used instead of one, and so arranged that the steam is expanded from 100 lb. pressure down to 34 lb in the first cylinder, then exhausted into the second, and expanded down to 2 lb., the temperature range in the first cylinder will be $337 - 729 = 58$ deg., and in the second $279 - 219 = 60$ deg.

The decrease in temperature range in each cylinder causes a considerable reduction in the total condensation for the entire expansion. This holds true to a certain extent as the number of cylinders is increased to 3 or 4.*

With a simple engine, cylinder condensation limits the initial pressure to 80 or 90 lb. and the number of expansions to about 4, while with the compound type pressures of 130 to 140 pounds are common, which gives an economical range of expansion up to 8 or 10 times.

The principal objection raised to the use of compound engines, aside from their greater cost, is the falling off in economy when underloaded, which is somewhat greater than in the case of a simple engine. The load in an office building is subject to a wide variation during the period which the engines are operated, especially if electric elevators are connected with the circuit. This condition is gotten around to a considerable extent by using several units of different sizes and throwing in such a combination as most nearly meets the requirements at different parts of the day. When electric elevators form a considerable part of the load they are often put on a separate circuit, as their operation on a lighting circuit is liable to dim the lights when first starting and the current consumption is heavy.

Turbine for Small Plant

THE steam turbine has been largely confined to central plants, using high pressures and large units, but the development of the small and medium-sized turbine should make it applicable to isolated plants with fair results. One objection to its use in connection with a heating system has been the necessity of a high vacuum on the exhaust to secure the best economy, but manufacturers now claim a reasonable economy when running non-condensing, which makes it available for use in heating systems where all of the exhaust is usefully employed.

Plants equipped in this manner should be provided with condensers for summer use if cooling

*"Power Heating and Ventilation"

water, can be secured at reasonable rates. Steam economy, length of heating season, cost of cooling water, fuel, etc., must be looked into carefully when designing a power plant, and a selection of the apparatus be made accordingly. No attempt will be made to go into the electrical side of the plant except to include a few practical points taken from Power, Heating and Ventilation.

Electrical Equipment

IN operating an electrical machine, there is a certain loss in energy, due partly to the friction of the mechanical parts, and partly to the resistance to the current. The ratio of the amount of energy which a machine gives out to that which it receives, is called the commercial efficiency. For example; if an input of 100 hp. of mechanical energy is given to a generator and only 90 hp. of electrical energy is delivered, the efficiency is $90 \div 100 = 0.9$, or 90 per cent. The efficiencies of generators vary according to their size and the load carried. Tests of a standard make show an efficiency of from 85 to 93 per cent for sizes ranging from 5 to 200 kw. at full load, and an efficiency of 82 to 85 per cent for the same machines at half load.

Operating Schedule

AS already stated, in a lighting plant the load is light during the day and is at a maximum for a few hours only during the evening. For this reason there should be several units so arranged that as the load increases their power may be successively added as required. The relative size of the units is a matter upon which there is some considerable difference of opinion. The best economy is obtained where large machines are used during periods of heavy loads and those of small size during light loads. While greater economy may be secured by making all of the units of a different size, certain practical considerations may often lead to a different course.

It is the custom of many engineers, in plants of medium size, to divide the total capacity into 3 equal units, each of such size that 2 of them, by being operated at 30 per cent overload, can do the maximum work satisfactorily. This permits of the withdrawal of 1 unit in case of accident or repairs, and besides, the 3 are interchangeable on the work.

Their first cost is usually less, they adapt themselves better to the available space in the engine room; only 1 size of parts need be kept for repairs, and in case of accident the plant would not be crippled as would be the case if the units were of different size and the largest should break down at the time of heaviest loading.

The size of the dynamo in connection with light loads, is not of so much importance as that of the engine, for its efficiency does not decrease so rapidly with under-loading. Even at 1/3 load, the efficiency of some dynamos is but little less than at full load; also small dynamos are made nearly as efficient as those of large capacity, so that it is allowable to suit their size and number to the requirements of the engines.

Sometimes where the day load is very light, 4 units are used, their power being in the proportion of 2, 2, 1 and 1, and of such capacity that the 2 larger or 1 of the larger and the 2 smaller, can do the entire work without overloading. This leaves 1 of the smaller for the day load. The best arrangement in any case must be worked out to cover local conditions, and the above methods are given more as suggestions than as rules to be exactly followed.

The methods of determining the capacity of the generators has already been given as a step in finding the boiler power for electric lighting, elevator service, etc., and need not be repeated here. The size of engine required for driving a dynamo depends upon the efficiencies of both machines. For full loads, under ordinary conditions, we may assume an efficiency of 80 to 85 per cent for engines up to 100 hp., and 85 to 90 per cent for larger sizes; and efficiencies of 85 to 90 per cent for generators up to 100 kw. and 90 to 95 per cent for larger machines. The method of proportioning the engine to generator may be illustrated by a practical example, as follows:

What must be the indicated horsepower of an engine to drive a dynamo delivering 100 kw.? As the horsepower of the engine must always be greater than the kilowatt rating of the dynamo it is evident in this case that it must be more than 100, and we can, therefore, assume an efficiency of 85 per cent. We have 100 kw. $= 100{,}000$ watts $= 100{,}000 \div 746 = 134$ hp. If the efficiency of the dynamo is 90 per cent, and its output of energy is to be 134 hp., the output or delivered horsepower of the engine must be $134 \div 0.9 = 149$. If the efficiency of the engine is 85 per cent, the indicated horsepower will be $149 \div 0.85 = 175$. Putting this in the form of a rule we have:

$$\text{I. hp. of engine} = \frac{\text{kw.} \times 1000}{746 \times \text{A} \times \text{B}}$$

in which A = efficiency of engine, B = efficiency of dynamo. Taking the lower efficiencies as given above, we have, indicated horsepower of engine = kw. of dynamo $\times$ 1.75 for dynamos up to 100 kw., and kw. $\times$ 1.57 for larger sizes.

Foundations

ALTHOUGH drawings for the foundations are usually furnished by the builders of engines, the designing engineer should have a general oversight of this part of the work to see that it conforms to local conditions. Care should be taken not only to make the foundations stable, but to construct them in such a manner as to prevent vibration from being transmitted to nearby rooms and buildings. A loose or sandy soil does not carry such vibrations as readily as firm earth or rock. One of the most common ways of preventing vibration is to make a larger excavation than is required for the foundation, 2 or 3 ft. in each direction, and pack the space with moist sand.

In designing a foundation, the following permissible loads per square foot may be used, depending upon the kinds of soil; hardpan, 8 tons; gravel, 5 tons; clean sand, 4 tons; dry clay, 3 tons; wet clay, 2 tons; loam, 1 ton. These figures apply simply to the weight to be cared for, and vibration must be provided for independently. For units of 200 kw. and less it is customary to start with a footing of concrete 12 to 30 in. in thickness, and of an area to be governed by the nature of the soil. If the foundation is to be of brick, it should have a batten of about 1 to 6. This and the area of footing will fix the depth. Concrete is generally used for foundations at the present time, but the general form and size may be the same as described above. If brick is used for the foundation, the top should be capped with hammered stone. Generators are usually mounted on a wooden base to furnish insulation for the frame.

Motors

MOTORS employed in office buildings are used principally for operating ventilating fans and elevators. For fan work the direct-connected motor on direct-current is preferable, on account of compactness and greater quietness of action. This is due both to the slower speed of the motor and to the absence of belts.

In the case of small fans, the motor may be attached directly to the framework of the housing, making the fan of the single inlet type, but for larger sizes it should be mounted upon a separate foundation at a sufficient distance away to give free access to the air inlet upon that side of the fan, also.

When the motor is connected in this manner, the power should be transmitted to the fan shaft through a flexible coupling in order to prevent binding and consequent heating due to imperfect alignment of the fan and motor bearings.

If direct current is not available, and alternating current must be used, the advantages of electric driving are greatly reduced, as high-speed motors with belts must be used, and furthermore, satisfactory speed regulation is not easily obtained.

Motors in basement rooms, where an earth footing is attainable, are usually mounted on a brick or concrete foundation with a wooden cap or framework the same as for a dynamo. When it is necessary to reduce the vibration to a minimum, a sound deadener, made up of several layers of hair felt, between 2 sheets of lead, may be placed between the base of the motor and the foundation, before drawing down the anchor bolts. Another method often employed is to build an 8-in. brick wall around the central portion of the foundation about 8 in. distant, and pack the space between them with moist sand.

Both direct-current motors and alternating-current motors of the induction type are used for elevator work. Under these conditions speed controllers can be used with an alternating current because the periods of speed reduction are short and not continuous as in the case of a ventilating fan.

In specifying a motor, one of ample size should always be called for. It should be provided with the maker's name plate, giving rated current, voltage, speed and capacity.

The manufacturer should be called upon to give a guarantee similar to the following: That the machine will not heat in any part of its windings to more than 80 deg. F. above the temperature of the surrounding air, after a continuous run of 6 hr. duration, under rated load conditions; also that it will carry 25 per cent overload for 2 hr. and momentary overloads of 50 per cent without excessive heating or sparking. The current from which the motor is to be supplied should be fully described; the voltage given, and if alternating, the phase and frequency should be stated.

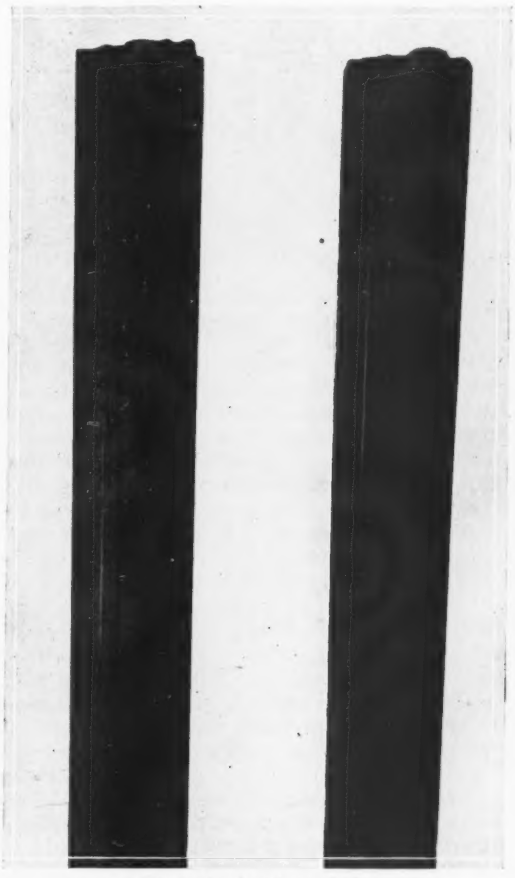
Elevators

THIS item of equipment will be only touched upon briefly and no attempt will be made to discuss the merits of the various kinds of elevators in use. Electric elevators require but a comparatively small amount of space, and the operating machinery may be placed upon the roof if desired, thus leaving the basement free for other purposes. The hydraulic elevator of the direct plunger type is a desirable form where it is possible to sink the cylinder to the required depth. It is practically impossible for an elevator of this kind to fall, on account of its peculiar construction.

The only floor space required for this type is that occupied by the pumps and the passage of the plunger cylinders through the basement story. Hydraulic elevators of the cylinder and sheave type, both vertical and horizontal, require a certain amount of floor space in addition to that occupied by the pumps.

GAGE GLASS CORROSION

RECENTLY samples of gage glasses were referred to this office for a diagnosis of what had caused the corrosion in them. The condition of the glasses was bad and in order to secure definite information we got samples of boiler feed water before and after treatment and of the boiler compound as used. These were examined in the Miner Laboratories of Chicago, Ill., and it was found that the sample of water marked "after injection of compound" was highly alkaline, the alkalinity amounting to 0.8 of 1 per cent, calculated as sodium carbonate. The report states that upon concentrating this water in the boiler,



CORRODED GAGE GLASSES

as would be done by evaporating it to steam, a highly alkaline liquid would result, and this would corrode the glasses, by forming soluble sodium silicate from the glass. The remedy was, of course, to use less of the compound as the extra strength not only affects the gage glasses but also the metal of the boiler, and in addition tends to cause foaming. This is no criticism of the compound, which, if used in the proper strength would be satisfactory in its operation.

THE GAGE

By F. W. Bentley Jr.

THE steam gage is an important factor in uniform and steady power supply, consequently, upon its action no little dependence is placed. Yet in most cases, the amount of importance it is forced to assume varies inversely with the amount of care and attention it receives.

Many times the only consideration given the gage is for its appearance and location—appearance, which extends to its habitual possession of a polished face rim, for looks, and the eyes of the boss; and location, that it might cause the tender but little inconvenience to view it, no matter what the surrounding conditions are where it is placed.

There are many men, extremely competent in handling and controlling machinery, who justly deserve

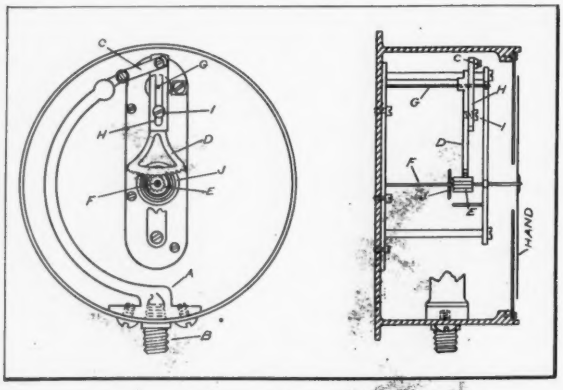


FIG. I. INTERIOR VIEWS OF STEAM GAGE

the title of engineer, but through lack of occasion, or necessity, give the gage and its whims but little attention. A description and illustration, explaining the construction and operation of the gage, will exemplify its nicety of construction and emphasize things mentioned for its welfare

The 2 views of Fig. 1 disclose the inner and vital working parts of a gage. There are different makes, employing different assemblies of leverage and gearing, but the principle of operation is the same in all cases—the principle being the means of securing a graduated register of pressure by the hand on the dial face.

Part A might be said to be the heart of the gage. It consists simply but necessarily of a thin, elastic, hollow, metallic tube, curved to fit the body of the gage. In performing its function, it undergoes a specific amount of convex expansion, proportionate to the pressure of water within it, which is forced by the steam at the condensing point in the connecting pipe, joining the tube, and subsequently the gage at B. The expansion or Bourden tube as it is called, is extremely sensitive and any alteration of pressure will produce instant effect on it, and barring lost motion in the levers will show the result of such alteration by motion of the hand over the dial.

From the free, or top end of the Bourden tube, lever C connects with the sector D, which moves pinion E. Pinion E is shrunk tight to shaft F, onto which the hand is driven. The sector rotates or works on its shaft G. The government of the hand by the Bourden tube can now be readily seen.

Often from circumstances the engineer has nothing to do with the testing or adjustment of the gage, and a little further time spent on that work might be worth while. Again referring to Fig. 1, it will be seen that held to sector D by adjusting screw I, is the adjusting slide H, and to its upper end is connected the lever C from the Bourden or expansion tube. By loosening screw I and dropping the slotted adjustor slide down, the connected end of lever C is brought closer to the shaft G, on which the sector turns. Thus with the same amount of pull from the tube, the sector will travel farther at the other end, which meshes with the hand pinion E, giving it more revolution and greater travel of the hand. By moving the slide H up, the sector will give less travel at the lower or geared end, and consequently fewer turns of the hand stem pinion E. The following cases will make the need of such adjustment more clear.

A gage on the test device, for instance, registers 90 lb. when 100 lb. should be designated as a result of the pressure in the test appliance. The slide must be moved a trifle downwards, bringing the connection of lever C closer to the sector shaft G. As a result the hand possesses more travel and stands now over the 100 lb. mark on the dial. The gage in another case, registers 100 lb. when but 90 lb. is called for by the test apparatus. A little upward movement of the adjustor slide will, this time, allow the sector less travel over the pinion, and give the hand a slightly lower register on the dial.

The peculiar characteristics of the Bourden tube, make adjustments of the slide more effective at higher pressures than at lower, consquently the correctness of the gage at lower pressures will not be disturbed.

The small hair spring J is to assist the hand in returning to the stop peg, and consequently the zero

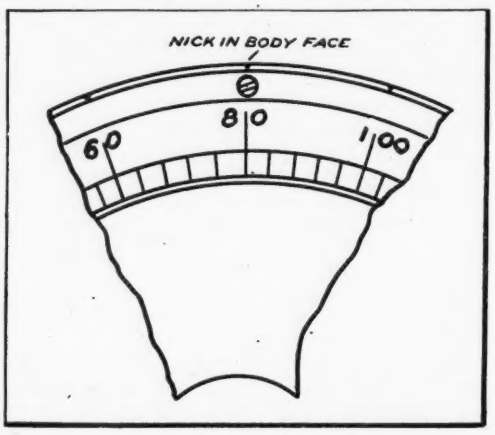


FIG. 2. SECTION OF GAGE DIAL

mark. One end of the spring fastens to the hand stem pinion, and the other to some separate and stationary part of the shaft support. The movement of the pinion is against the spring, and tightens it, and as the pressure decreases, the stored resistance of the spring helps in a quickened register of the decrease, and lastly brings the hand against the stop peg at zero.

While the gage is on the test apparatus, with all connections tightened, press it laterally, not hard

enough of course to strain the connections. The hand may move for a difference of 5 to 15 lb. This is caused by the large tube screws at the base, being loose. They often become loosened, and due to the pull and twist of the connecting pipe, force the gage to register incorrectly. The hand moves because the tube is loose from the gage body, to which the sector and its connections and supports are generally securely fastened.

After the dial has been removed for adjusting the slide, there would seem to be no way of ascertaining whether the result of adjustment would secure the desired register. While the dial is still on, small nicks can be made with a fine file in the thin outer face of the body shell, each nick made opposite above, or below, each graduating mark on the dial. On the heavier outer surface of the body mark with chalk the lb. pressure each nick represents according to the dial. Fig. 2 can perhaps make the meaning clearer. There is then possessed, something to watch the hand movement by, when the dial has been taken off.

The pressure should be run up to a lower pressure, which was correctly registered by the gage, the hand tapped on, and the pressure increased to the amount where the gage was wrong, and the adjustments of the slide there made.

The hand may often not return, to the stop peg at zero stroke, which indicates a weakness of the hair spring J. The tubes can be sprung, forcing the sector clear of the pinion, where the stem connected to the pinion can be grasped and given a few turns.

Time, heat, and other conditions surrounding the gage often leave the face of the dial dulled and undistinguishable. The paint in the grooves cracks,

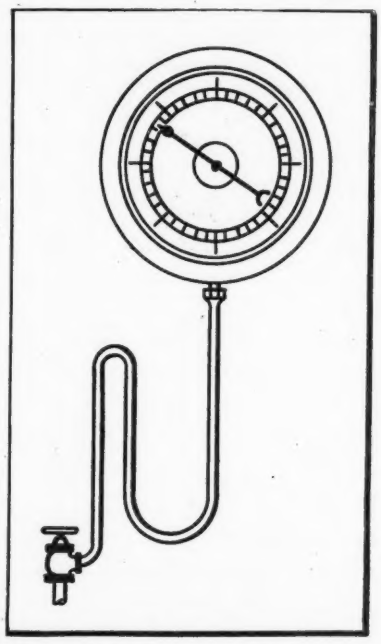


FIG. 3. GAGE CONNECTION TO BOILER

drops out, and leaves the pressure and pound marks sometimes undiscernable. The face is of course easily scoured with flour of emery and oil, but to paint the number slots, and grooves, is hard to do neatly with a brush. A quick way, is to daub the paint into the hollowed portions thoroughly, and with a piece of stiff paper held flatly to the metal, wipe off the surplus.

For cleaning out the gearing or meshing of the sectors and pinions, gasoline or alcohol is best, as it leaves no matter which might gum, or thicken. If a lubricant must be used it should be of the lightest, as the least gum or sticky material in the mesh weakens the effect of the hair spring, and leaves the hand sluggish and slow in its movement on the dial.

Conditions surrounding the gage in its connection with the boiler, are important factors in its correct

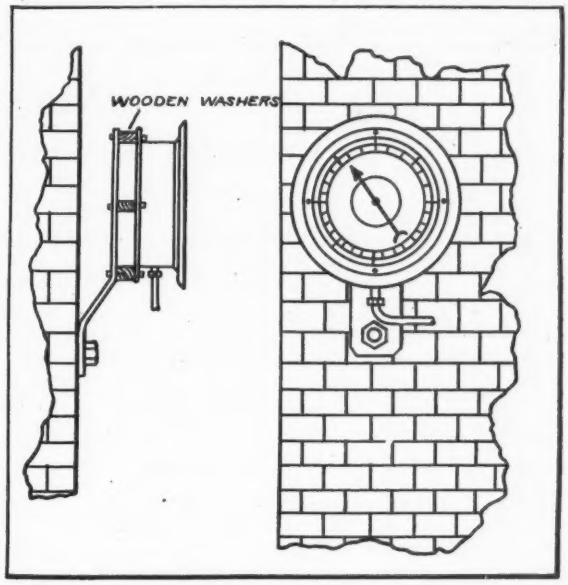


FIG. 4. GAGE MOUNTED ON BOILER WALL

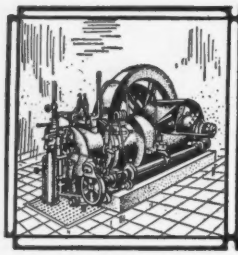
performance. Its parts are extremely sensitive, and if placed near the boiler it absorbs the sometimes intense heat of the boiler and the tube unduly heats.

Another cause of incorrectness, and even damage to the gage are leaky connections from the boiler. The Bourden or expansion tube is at all times to be filled with condensed water, and the steam should force the water to the pressure carried. Where the gage is placed above the cock, communicating to the boiler, leaks in the connections of the cock, or in the packing of its stem, will allow the condensed water to leak away, filling the gage with hot steam, unduly expanding the parts, and heating parts which are to be kept at very low temperatures.

If the gage must necessarily be above the valve or cock from the boiler, a copper pipe should be used as in Fig. 3, to keep a certain amount of water for the tube in case leaks should arise to drain the pipe. The bend retains amount of water, which, on the opening of valve, enters the gage, and also allows a reservoir of continual supply.

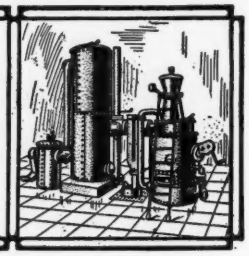
Where the gage must be near the boiler, it should be so placed as to afford but little contact with the heated parts and permit a good circulation of air around it. Fig. 4 shows a method which can be used to good advantage and effect.

A plate with a good strong off-set at the bottom can be bolted to some projection, or slipped over the end of a truss and the nut replaced, holding the gage support or plate. In connecting the gage to the plate, the small bolts should be quite long enough to permit the use of a small wooden washer, bringing the gage away from the plate. In this way the gage can be kept cool by the circulating air and do its work as it should.



Gas Power Apparatus

Producers, Engines and Industrial Applications



LONDON LETTER

THERMAL EFFICIENCY OF TWO-CYCLE ENGINES

By W. A. Tookey

RESULTS of an extended series of experiments having for their object the investigation of the thermal efficiency of a 2-cycle gasoline engine have recently been reported to the (British) Institution of Automobile Engineers by Dr. W. Watson of the Royal College of Science. The engine tested was a single cylinder Day engine intended for marine use and rated by the makers at 2.5 hp. at 900 r. p. m. the cylinder having a bore and stroke of 3¼ in.

Description of Engine

FROM the sectional elevation of the engine, Fig. 1, it will be seen that the crank case is employed for compression and that the engine is of the 3-port type in which the admission of the fresh charge to the crank

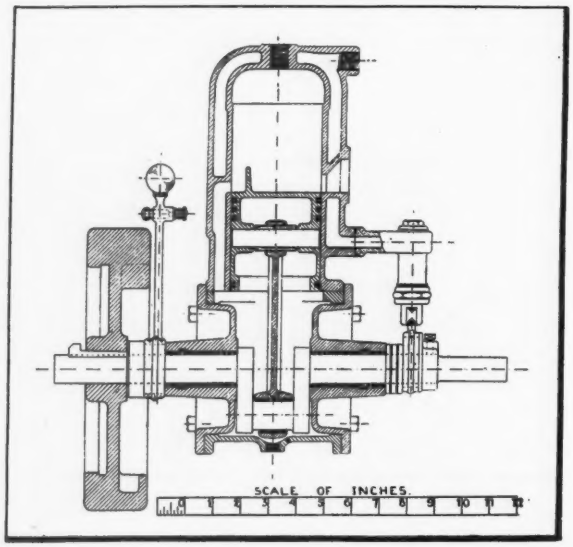


FIG. 1. SECTIONAL ELEVATION OF DAY 2-CYCLE ENGINE

case is governed by the piston, the lower edge of which uncovers a port when near the top of the stroke. The upper edge of the piston on the downward or working stroke first uncovers the exhaust port and then the inlet port, which is in communication with the crank case. The valve diagram gives the position of the crank at the opening and closing of each of the 3 ports and enables the time during which each port remains open to be noted. The usual deflecting plate is provided on the top of the piston to prevent the incoming charge passing directly to the exhaust outlet.

Ignition

THE ignition device included high tension coil, trembler and battery. As sent out by the makers, the maximum spark advance gave a diagram as illustrated, Fig. 3, in full lines when the engine was run at 900 r. p. m. An alteration was made so that further advance could be obtained to give the diagram shown by dotted lines, Fig. 3, which gave an increase of power of 15.6 per cent at the rated speed as above and even more at higher speeds.

Methods of Measurement

NECESSARY steps were taken to measure the air taken into the engine through the carbureter and during the experiments that periods of observation lasted until a measured quantity of gasoline had been consumed. The exhaust gases were sampled. The exhaust pipe was 1¼ in. internal diameter and about 12 ft. long, having a silencer fitted at a distance of 22 in. from the engine.

Power developed by the engine was absorbed by a dynamo belt driven, the current being led through adjust-

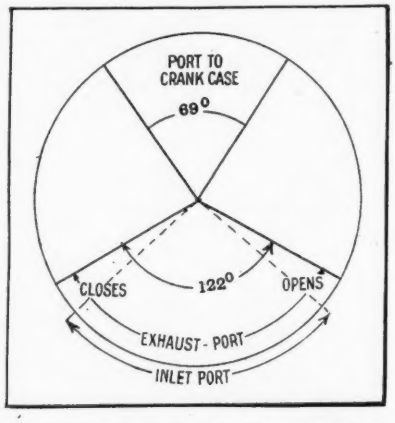


FIG. 2. VALVE OPERATION DIAGRAM

able resistances by means of which the output of the machine could be regulated and the speed of the engine controlled. The diagrams were taken by means of an optical indicator. No attempt was made to measure the brake horsepower on account of the friction of the belt drive and load upon the bearings due to belt tension being an unknown quantity. However, the indicated horsepower, when the engine was running light, was determined at the various speeds and from the figures obtained approximate values for brake horsepower were computed from each test.

Leakage of Mixture Through Exhaust Port

BY noting the percentage of nitrogen detected by analysis in the exhaust gases the total volume of oxygen entering the engine could be calculated and compared with the percentage of oxygen actually found in the exhaust. The difference between the original volume of air admitted and that rejected indicates the volume that has been used up in supporting combustion, and also the volume that has escaped without doing useful work and, therefore, must have leaked out of the cylinder with the exhaust gases during the time the piston was passing the open ports at the end of the downward or working stroke. In this manner the percentage of the mixture escaping combustion in this manner at the various speeds at which the engine was tested was determined.

It was found that at a speed of 600 r. p. m., 35 per cent of the charge escaped; at 900 r. p. m., about 30 per cent; at 1,200 rev., about 20 per cent; at 1,500 rev., about 7½ per cent. These figures are very striking and deserve to be particularly noted.

Strength of Mixture

IN the paper in which the results were recorded, figures were given for 35 different tests. Of these, 6 were at 600 r. p. m.; 10 at 900; 7 at 1,200; and 12 at 1,500. The strength of mixtures varied in each separate test from about 10 to 17 parts of air to one of gasoline by weight.

With regard to the latter it appears that the ratios were given in relation to the whole of the air admitted to the engine cylinder through the carbureter, and did not take into account the proportion of the charge that escaped through the exhaust unused as referred to in a previous paragraph. Such ratios are in common use among makers of automobile engines but it is nevertheless regrettable that the mixture strengths were not given in a form which all internal combustion engineers could appreciate.

As far as the present summary is concerned, therefore, Dr. Watson's figures will be varied so as to take into account the leakages at the various speeds referred to by him and dealing only with the amount of stuff—air, gasoline, and exhaust products—retained in the cylinder and taking part in the explosions. The mixture strengths also are referred to in terms of the number of B. t. u. of heat contained in a cubic foot of such stuff, as calculated from the published figures after allowance for wastage in the manner described.

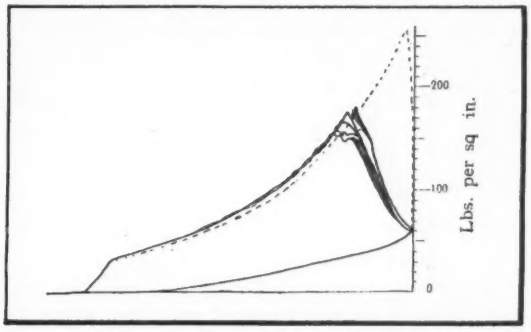


FIG. 3. INDICATOR DIAGRAMS FOR MAKER'S ADJUSTMENT AND WITH SPARK ADVANCED (DOTTED)

In order that 2 different methods of stating the mixture strength can be visually appreciated, reference should be made to the accompanying Fig. 4. Here the ratios of air to gasoline by weight have been plotted horizontally, and the number of B. t. u. per cubic foot of working mixture plotted vertically.

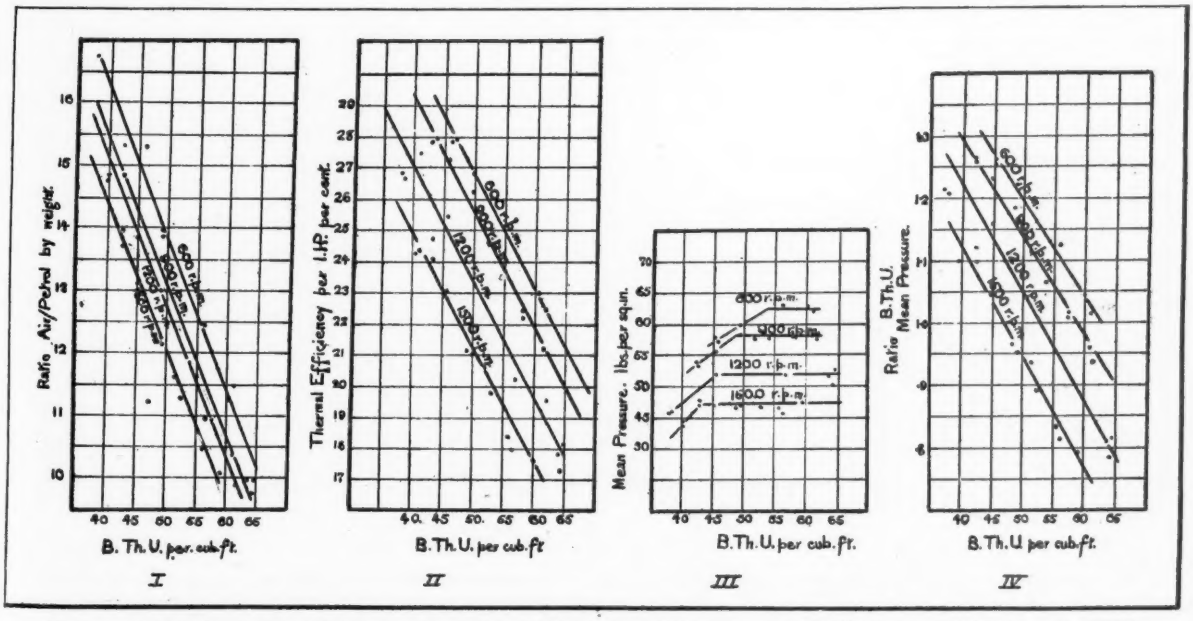

Ratio Air/Petrol by weight.
B. Th. U. per cub. ft.
I
Thermal Efficiency per I.HP per cent.
B. Th. U. per cub. ft.
II
Mean Pressure, lbs. per sq. in.
B. Th. U. per cub. ft.
III
Ratio B.Th.U. Mean Pressure.
B. Th. U. per cub. ft.
IV

FIG. 4. VARIATION OF VALVES WITH HEAT VALUE OF MIXTURE: I RICHNESS OF MIXTURE. II THERMAL EFFICIENCY BASED ON INDICATED HORSEPOWER. III MEAN EFFECTIVE PRESSURE. IV B. T. U. PER POUND OF MEAN EFFECTIVE PRESSURE

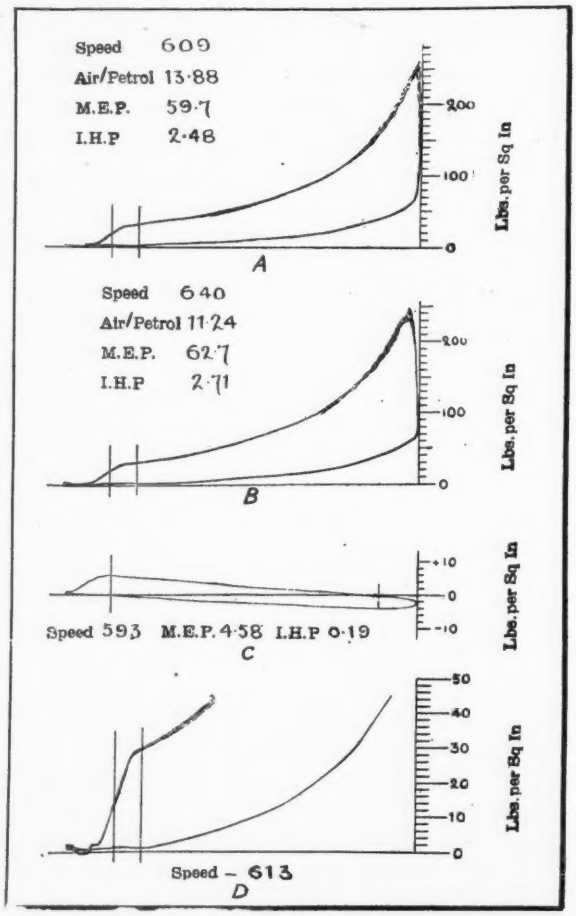
It will be seen that while the 900 and 1,200 series of tests are practically identical the 600 and 1,500 series vary considerably. The differences are to be explained by the fact that in the one case the residuals are not taken into account while in the other they are included in the computation.

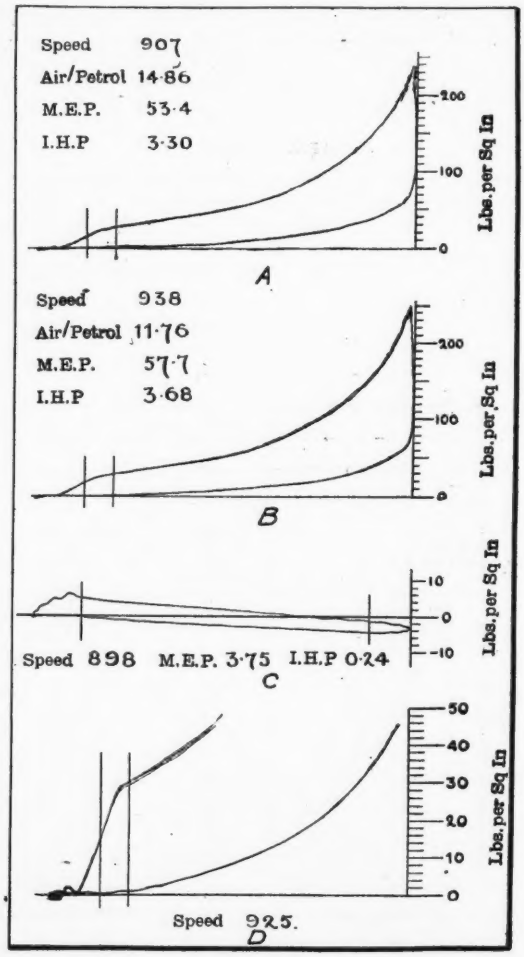
Thermal Efficiency On Indicated Horsepower

CHART I. shows the relation between the mixture strengths of the working charges and the indicated horsepower thermal efficiency at the 4 different speeds.

It is striking to observe that throughout the explosive range, the weakest mixtures give the highest efficiency. It will also be seen that the efficiency is reduced as the engine speed increases. The latter phenomenon suggests that in some manner, probably due to the incompleteness of the scavenging after each explosion because of the resistance of the exhaust silencer and connections, the proportion of heat usefully applied in power production is reduced directly with the increase of speed.

In each test the timing of igniton was adjusted to give correct diagrams and throughout the experiments the compression pressure was practically constant, varying between 62 and 65 lb. per sq. in.. The latter by itself is not a true guide to the explanation required as the cylinder content as far as volume is concerned is unaffected by the speed. But the composition of the charge is affected both by the retention of exhaust products and by the resistance to the admission of the fresh charge through the carbureter.





FIGS. 5 TO 8. CARDS AT VARIOUS SPEEDS. A, LOW SPEED; B, HIGH SPEED; C, CRANK CASE; D, EXHAUST AND ADMISSION WITH WEAKER SPRING. FIG. 5 AT 600 R.P.M.; FIG. 6 AT 900; FIG. 7 AT 1200; FIG. 8 AT 1500

Mean Pressures

CHART III. is interesting in that it records the fact that at all speeds there is a certain maximum mean pressure attained beyond which no increasing richness of mixture results in increase of power. Further that as the speed increases although the mixture strength may be the same, and the ignition equally well timed yet the maximum effective pressure resulting from the explosions is reduced.

It will be seen too, that this reduction is equal with equal speed variation. The regularity of the figures as plotted in this chart is very curious and seems to warrant the inference, that as the velocity of the moving gases within the walls of the cylinder increased with the speed of the piston this supports the theory recently advanced in connection with the transmission of heat through plates, that the more rapid the passage of the gases against the plates, the greater the transmission of heat.

From Chart III. it will be observed that the mean pressure falls off very considerably with the weaker mixtures, but even so, the ratio obtained by dividing the mean effective pressure in terms of pounds per square inch by the mixture strength in terms of British thermal units per cubic foot of working mixture, is found to be unaffected in its gradual improvement as the mixture gets weaker. This can be clearly seen from Chart IV.

Effect of Scavenging

ONE lesson that stands out prominently from the results of the experiments is that the efficiency of a 2-cycle engine is greatly dependent upon the thoroughness with which the cylinder is cleared of exhaust gases. The writer had this brought to his notice in a striking manner when making a test of an engine of this type a month or 2 ago. He was called in to report upon the performance of this particular engine when taking its

fuel from a kerosene carbureter so as to issue a certificate in connection with negotiations for sale.

When set to work under a certain resistance, the full speed that could be obtained was about 750 r. p. m., which was slower by 100 rev. than had been previously reached under similar conditions. No silencer was fitted to the exhaust piping but there were several elbows and bends in the connections to lead the residuals out of the testing room.

Upon inquiry the writer elicited the fact that at the previous trial the exhaust pipe had been taken straight out without bends, the devious connections having been specially arranged for his comfort. Upon instructions being carried out to lead the exhaust straight through a short pipe, there was an immediate increase of speed

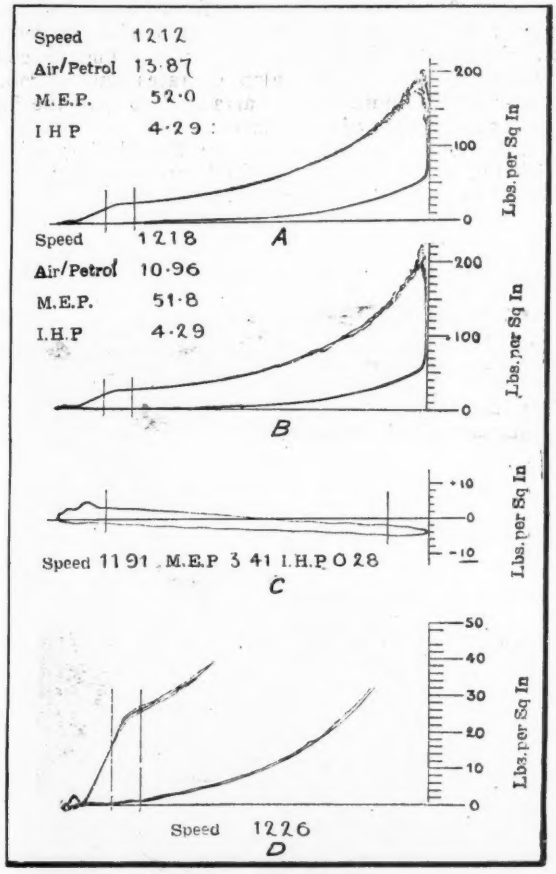


FIG. 7. 1200 R.P.M.

and the extra revolutions were obtained without further adjustment.

Size of Carbureter

THERE is no doubt but that during Dr. Watson's tests at high speeds, the velocity of the charge through the carbureter was much too high. Indicator diagrams taken from the crank case with a weak spring show conclusively that while at 600 rev. the pressure of the compressed charge immediately before the aperture into the cylinder is opened by the piston, is 6 lb. per square inch, this is reduced at all higher speeds; 5¼ at 900; 4 at 1200; 2 at 1500. Similarly at all speeds other than the 600 r. p. m. tests the pressure of the exhaust products in the cylinder and connections was greater than the charge awaiting admission, therefore the diagrams show a hump immediately after the point of inlet port opening, Figs. 6 to 8.

Again, the crank case diagrams also show how, as the speed increases, the loop marked by the curved lines during the opening of the carbureter port into the crank case becomes flatter and flatter. As a consequence the point along the atmospheric line where the charge under compression in the crank case crosses, becomes nearer and nearer the point at which the inlet port into the cylinder is opened by the piston upon its downward stroke.

Sensitiveness to Mixture Variations

ONE peculiarity of 2-cycle engines is their sensitiveness to irregularly proportioned mixtures. Unless the mixture is adjusted within comparatively narrow limits

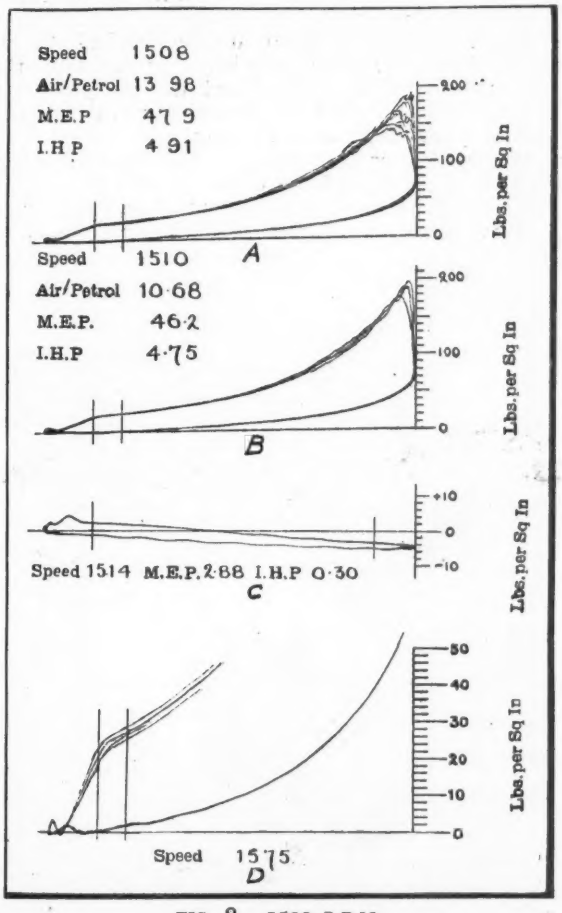


FIG. 8. 1500 R.P.M.

and particularly at high speeds, the engine refuses to work upon the 2-cycle and only fires at every other out stroke, the intermediate one acting as a scavenging stroke. This phenomenon of unsatisfactory working is likely to occur unless the carbureter provides a mixture of uniform richness at different speeds and for different throttle openings. Even when the effective area of the carbureter jet is hand adjusted by means of a needle valve, it is often difficult to hit upon the correct mixture at high speeds.

HE WHO TRUSTS to luck will not be lucky. It is the man who does the right thing at the right time who is lucky.—System.

A MAN MAY HAVE honesty, health and ability, but without enthusiasm he will be only a statue.

COAL HANDLING IN MUNCIE ELECTRIC LIGHT PLANT

LABOR required to handle the coal and ash in the boiler room is one of the big items in the operation of a power plant and this, for a number of years, has been reduced in large plants by employing mechanical means for doing the work. Recently somewhat similar methods have been extended to plants of moderate and small sizes and their success in reducing operating costs has been demonstrated in many plants, including those operated by the American Gas & Electric Co. which now has a number of its plants equipped with coal and ash handling machinery.

In this company's plant at Muncie, Ind., is installed a complete system for handling coal from the railroad cars to the stokers and the ash from the furnace. The railroad cars containing coal are run into the yard under a 70-ft. span open girder type crane operated on an elevated track approximately 70 ft. from the top of the crane rail to the ground. This crane is equipped with a man trolley, from which is suspended a grab bucket which has a capacity of 54 cu. ft. or about 1½ ton, and which is actuated at a speed of 250 ft. per minute. By the means of this machinery, the coal is delivered from the cars at the rate of about 60 tons per hour, either to the ground storage or to a traveling crusher located upon the roof of the boiler house, where it is crushed and delivered into the overhead bunkers in the boiler house to be delivered to the stokers at the will of the fireman.

The bucket, Fig. 3, is of the 4-rope type, where 2 ropes are for closing the bucket and the other 2 ropes are for holding and lowering. This bucket is of the bull wheel type, being closed by means of flat closing chains and the path of the scoops or spades is obtained by means of a lever system which prevents the interference of the back of the scoop with the material.

The operating mechanism for the bucket in the man trolley is arranged so that the bucket is hung directly from 3 drums, the two hold ropes being fastened to the center drum and the two closing ropes to the 2 outside drums. The closing drums are geared direct to a 50 hp. series wound crane type motor, and the hold drum is geared to another motor of the same type and size, thus giving 2 motors entirely independent of each other for the manipulation of the bucket. These 2 motors are fitted with solenoid brakes and are controlled by means of a magnetic switch control panel operated by one master controller. This controller also operates the solenoid brakes on the motor and is arranged to give the following operations of the bucket:

1st. One point of power on the closing motor with the brake released on hold motor to allow the bucket to sink into the coal while closing.

FIG. I. COAL HANDLING MACHINERY IN THE YARD AND ON ROOF OF MUNCIE ELECTRIC LIGHT PLANT

2nd. Four points of power with both brakes released to hoist the loaded bucket, the 2 motors equalizing under the strain of the loaded bucket.

3rd. One off position with both brakes set for holding the loaded bucket while traveling the crane or trolley.

4th. One kickoff point with the hold brake set for dumping the bucket.

5th. Four points of dynamic brake for lowering the empty bucket.

As all the operations of the bucket are entirely controlled from one master controller, the operator has only 3 controller handles to manipulate when

operating the crane, which are as follows: Bucket controller handle. Trolley controller handle. Bridge controller handle.

The bridge or crane has a clear span between centers of rails of 70 ft. and weighs approximately 35,000 lb. This bridge is actuated in either direction at a speed of 300 ft. per minute by a 25-hp. series wound motor. This motor is fitted with a solenoid brake

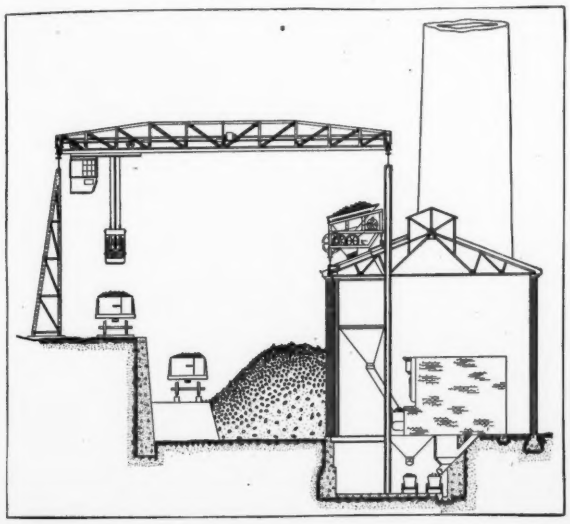


FIG. 2. DIAGRAM SHOWING COURSE OF COAL AND ASH THROUGH THE PLANT

for bringing the crane to rest, also for holding it against weather conditions.

The bridge and trolley controllers are fitted with a special point on either side of the off position, which cuts the power off the motor without releasing the solenoid brakes, therefore, allowing the crane to drift before bringing it to rest.

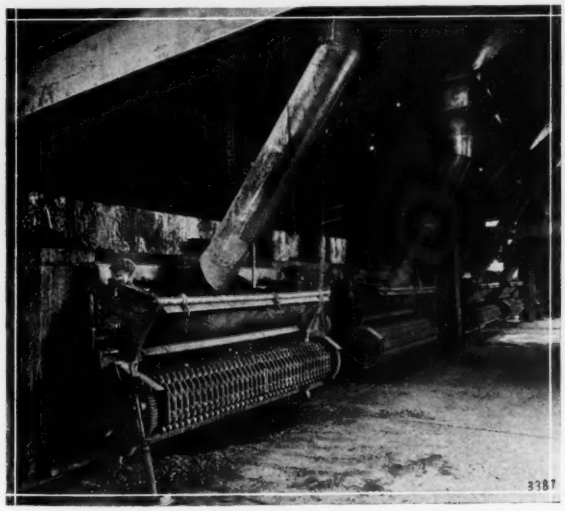


FIG. 4. METHOD OF DELIVERING COAL TO THE BOILERS.

For reducing the run of mine coal for use in the stokers, a single roll type of crusher is used. This crusher is mounted on a steel frame work mounted on 4 12-in. double flanged truck wheels which operate on a track placed the full length of the boiler house. This crusher is equipped with a receiving hopper approximately 12 ft. square and of such a size as to hold about 3 bucketloads of coal. This crusher is run by a 20-hp. shunt wound motor connected to the crusher by means of a belt drive. It delivers the coal through openings in the roof to the overhead bunkers in the boiler house and is moved along the track by placing the grab bucket alongside of the hopper and moving the traveling crane in the direction where the coal is to be discharged.

This plant has a capacity of approximately 3200 boiler horsepower and is equipped with 8 Stirling boilers of approximately 400-hp. each, which are fitted with chain grate stokers. The capacity of the overhead bunkers is approximately 500 tons of coal

The interior view of the boiler room, Fig. 4, shows the chutes leading from the bunkers to the chain grate stokers through which the coal is delivered, the amount used being controlled by a valve operated by a chain within reach of the fireman.

FIG. 3. JEFFREY CLASS A GRAB BUCKET WHICH HAS JUST BEEN FILLED.

Fig. 2 shows the method of handling the ash. Underneath the grate are 2 hoppers; that under the forward end being the reclaiming hopper, which is used to catch the unburned coal which falls through the grate and which is fed again to the stokers. The ash is dumped over the rear end of the grate into the ash hopper, where the contents are discharged into small dump cars, which carry them out of the building through an underground passage to a concrete ash hopper located in a position where the ash can be reclaimed by the bucket and discharged into railroad cars.

The entire coal and ash handling equipment used at this plant and also at this company's similar plant at Rockford, Ill., is the product of the Jeffrey Manufacturing Company, Columbus, Ohio, who designed the equipment to suit the particular needs of these plants.

SOME POINTS CONCERNING FIRE TOOLS

BY E. R. KELLEY

EVERY experienced mechanic knows that in order to secure the best results in the least time and for least money it is essential that he possess proper equipment.

Nearly all tradesmen pride themselves on the condition of their tools, seeing that they do not become rusty, out of shape and dull. It has been said that a skilled workman can do good work with the poorest of tools. This, however, is not saying that he always does good work with poor tools, but merely that it is possible for him to do so.

There can be no doubt but that a skilled workman can do better work with poor tools than an unskilled workman can with perhaps the best of tools. Admitting that to be true does not prove that poor tools are economical in the hands of any workman. Manufacturers discard machinery long before it is worn out and becomes useless merely because the machines do not represent the best tools they can procure, and they realize, even if the individual workman does not, that the best is none too good when endeavoring to secure the largest possible output with the least expenditure of time, labor and money.

For some reason that is not at all apparent to the casual observer, the fireman in the majority of steam plants, takes but little interest and pride in keeping in good condition the tools he is obliged to handle every hour of the day and during at least six days of the week. Is it because the fireman forgets that he is entitled to a prominent place among skilled labor, or merely because he has not been led to understand the advantages to be gained by keeping his tools in first-class condition? Whatever the true reason may be, it is a fact, nevertheless, that the fire tools in most boiler rooms are not kept in good condition, and in many instances they are of decidedly bad shape. The fire tools in the average steam plant receive about as little attention as possible and still have something with which to stir the fire and remove the ash. Much useless labor and a considerable amount of time and fuel could easily be saved by providing first class tools for caring for the fire.

The principal tools employed by firemen, and with different kinds of fuel are, the scoop or shovel, the rake, the spreader, the hoe and the slice bar. The scoop supplies the fuel, the spreader levels the fire, filling the hollows and reducing the high places, the rake works the ashes from under the bed of fuel without disturbing the surface, and also serves to draw out large pieces of clinker, while the slice bar loosens the clinker from the grates and side walls of the furnace. The hoe serves to clean the grates entirely of ashes and clinker.

The slice bar is the fireman's chisel, and in order to do good work and in the least time, and also with the least labor, it is necessary that the slice bar be of the most advantageous form, and sharp. The office of the slice bar is not to break up clinker by continued thrusts into the fire, but to raise a bed of clinker clear of the grates. The larger the pieces of clinker removed at one time the better, because the grates can thus be freed of these troublesome obstructions in a much shorter time and a larger amount of cold air can thus be kept out of the furnace.

One of the principal advantages of the mechanical stoker is that the fire can be fairly well cleaned and the clinker got rid of without opening the furnace doors and admitting a needless amount of cold air. It will be understood, therefore, that the less the fire doors have to be opened the greater the economy of fuel, provided the fire can be kept in good condition. It is evident that the fireman who can keep his fires burning bright and clear without having to keep the fire doors open longer than is absolutely necessary, even under the most favorable conditions, will be able to make the best showing and with less labor and fatigue.

In order to loosen a large area of clinker with a single thrust of the slice bar, the bar must be of the proper shape, and sharp, so that it will slide along the grate bars instead of riding up onto the first bed of clinker it reaches. A dull slice bar must be slid back and forth a number of times in order to accomplish what might be done with a single thrust of a sharp bar. It is evident that the longer the bar must be kept in operation the greater is the loss due to the chilling effect of the cold air rushing in through the furnace doors and the greater will be the injury to the bar. Aside from the waste of fuel and injury to the bar it is not desirable to use a dull slice bar, because it is hot, disagreeable work merely to stand in front of an open furnace door, much more having to work there, and especially during the summer months.

Some firemen continue to work, year after year, with rakes, slice bars and hoes, the handles of which are bent the wrong way for convenience and comfort. The handles have been bent the wrong way merely because the smith who did the work had been accustomed to bending them a certain way, and perhaps had never thought that they could be bent in any other direction to advantage. When the handle is being made it is no harder to bend it into a handy and comfortable shape, than to give it a century-old form merely because handles have always been bent that way.

The form and angle at which a handle should be bent is not the same in every case. When the grates are situated high above the boiler room floor a certain shape and a particular angle will be needed, and when the grates are relatively lower another form and angle will prove to be more comfortable. A fireman is not working to the interest of his employers nor is he earning his money to a greater extent when performing a lot of needless labor, than when he is working with tools which afford him the greatest degree of comfort possible. A man with handy tools should be expected to outdo the fellow who is constantly working in opposition to himself, and he generally does.

A properly trimmed scoop or shovel is not a difficult thing to maintain even with constant use, and it saves considerable labor, especially when the fireman takes pride in the appearance of his boiler room. A well trimmed shovel works much easier than one having long sharp ears, which prevent getting a good shovelful of coal, and invariably catch on the sides of the fire doors, thus spilling half the coal on the floor or sending it flying into the ashpit. Five or 10 min. a week spent in keeping the shovel in proper shape saves a considerable amount of needless labor in cleaning up after putting in a fire.

In the absence of a good shaking grate, the rake

provides the simpler and easier means of clearing the grates of ashes and small clinker, and when the rake is of the better form, by simply turning it over it becomes a poker and clinker hook. The accompanying drawings illustrate certain forms and proportions of fire tools that have been found to give very good satisfaction with stationary boilers. These it will be seen are particularly well adapted to horizontal boilers and those of the vertical type, and that they are not well adapted to the locomotive style of boiler with a deep firebox.

A number of slice bars in daily use are of the form shown at A in Fig. 1. The edge has become very

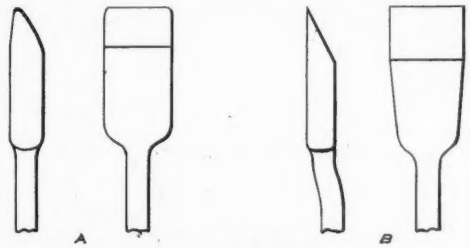


FIG. 1. FORMS OF SLICE BAR

dull and the corners are rounded off to such an extent as to cause the bar to glance off first one way and then the other when endeavoring to push it under a mass of clinker. It is only after repeated trials that the blunt end can be forced under the clinker and kept against the grate bar as should be done. At B is illustrated a form of bar that will save considerable labor over the bad form illustrated at A. A fireman can readily dress his fire tools without having to go to the smithshop, or having the tools continually being sent away for sharpening. A short piece of steel rail on a block of wood and a 1.5-lb. hammer are all the tools necessary, and these may be easily stored away in almost any boiler room. The beveled edge of the slice bar should be wide

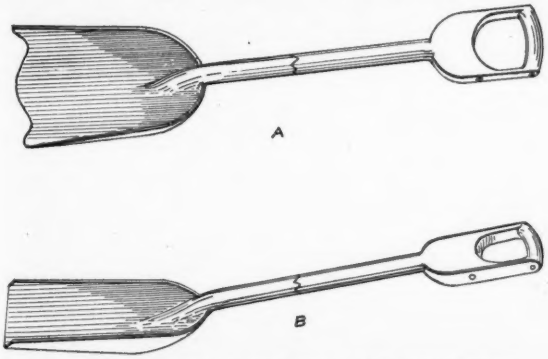


FIG. 2. SCOOPS OF PROPER FORM AND OTHERWISE

enough and of sufficient depth to avoid breaking the cake of clinker, so that the latter may be removed in large pieces and therefore as quickly as possible.

Figure 2A illustrates the shape of hundreds of shovels used in firing boilers. This represents an excellent labor producing tool or utensil, because it is almost impossible to shovel fine coal without spilling it all the way from the coal pile to the furnace door. Firemen who enjoy a clean floor in front of their boilers generally sweep back onto the coal pile the coal spilled when firing, and it follows that the more coal that is spilled the more sweeping is necessary. With a properly trimmed shovel but little coal is spilled, and a good appearance is maintained with very little labor. B represents a properly trimmed scoop.

There is no economy in using small shovels or scoops. When the shovel wears to a certain point it is cheaper to buy a new one than to continue to put in 6 or 8 shovelfuls of coal with a worn-out shovel when the same coal can be put in in 4 shovelfuls when using a new scoop. The value of the heat lost, due to the greater length of time the furnace doors must be kept open, more than equals the price of a new shovel in a remarkably short time. Then too, 4 shovelfuls of coal weighing, say 25 lb. each, can be put into the furnace with less fatigue than can 8 shovelfuls weighing 12 or 13 lb. each.

GETTING WHAT YOU NEED

BY WM. WESTERFIELD

I SUPPOSE that there are few engineers who have not had the satisfaction of being informed by the assistants when going on duty for the first time as chief engineer on a new job, that the manager would buy nothing for the upkeep of the plant. I have had the men in many instances say something like this to me when first going on: "You are up against it here, the plant is run down and the old man will buy nothing to put it in repair. I have made few changes but that this information came to me in one form or another when going to a new plant. I cannot remember more than one instance, where I remained for any considerable time, that I did not get what I wanted, or could reasonably expect.

It is but reasonable for the employer to desire some assurance that when he makes expenditures on the recommendation of his engineer he is acting wisely. It would not be good business for him to turn his pocketbook over to the engineer unconditionally. But there are few employers operating power plants who are not always ready to send little money after big, if you take the trouble to show them a reasonable probability that they will get what they are asked to go after.

I remember having taken charge of one plant, the total capacity of which was about 250 kw., the owner of which was a plain self-made man, who had accumulated about a half million dollars by hard work and hard sense combined with economy and denial. This man as might be expected was always ready to make a good investment. He observed small things closely, because he said the large ones obtrude themselves upon one, while we have to look for the small things, otherwise they will escape notice. It is often an aggregation of small causes that produce the greatest effects. This man would not willingly waste a penny, but he would invest large sums cheerfully.

When I took charge of the plant it consisted of 2 engines of 150 hp. each and one of 80 hp., all belt connected to appropriate generators. The engines were overloaded on the peak, while the engines were speeded too low, and the generators speeded too high —a bad combination. One of the larger engines had not been in service for over 2 years. It had been condemned by the former engineer because of unsatisfactory performance.

I found that the valve on the high pressure cylinder—it was a tandem compound Atlas—had been faced off, and at the same time the valve stem nut had been left full height, so that the pressure plate bore entirely upon it on the crank end without touching the valve. In addition to this, the inertia wheel

of the governor, which was of the old style Westinghouse type, was frozen to the main shaft, so that when the tension of the springs was relieved it required a great effort to rotate the wheel. After lining down the valve stem nut, and flushing the inertia wheel bearing with gasoline, and then supplying copious lubrication, securing new springs adapted to the speed the engine was to run, it ran as smoothly and with as good regulation as any engine I have ever seen having this type of governor.

The springs for this engine were the first thing I went after the owner for. It happened that just after getting this engine in operating condition, one night a heavy ground came on the line and flipped the belt off the machine driven by the other engine. It was but the work of a moment to get the rejuvenated engine in service, and when a few moments later the owner came in—the office was but a block away—it was going along in a manner to make one's heart glad. If there was ever a pleased man he was it then.

After this I had only to intimate that a certain thing would be a good investment, and he would say, "You know what you want, just write the letter and bring it in, and I will sign it and send it right off." I had, inside of 3 months, spent over $500 for improvements in this little plant, and at the same time I had cut down the fuel cost nearly one-half.

This is no fairy tale, but is an example from experience. It is only one of many that I have met with, and from many such, I have come to the conclusion that when the employer has reason to have confidence in the judgment of the engineer, he will act upon his suggestions, and as a rule, where this confidence is not given, it is not deserved.

I am aware that there is a class of employers operating small plants, who would rather have a bungler than an engineer if the bungler is amiable enough to be walked on. They employ a man, not for what he can do, but for what he will tolerate. They occasionally want some one to "cuss," and they would rather pay for a butt for abuse than an engineer.

AN EXHAUST STEAM HEATER AND PURIFIER

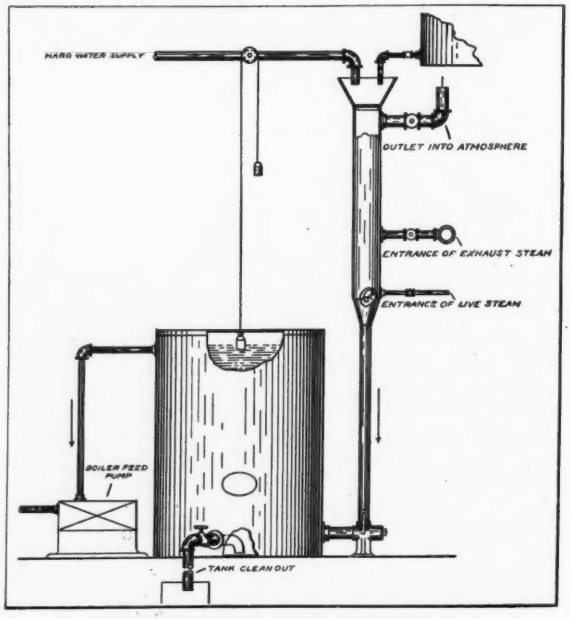
THIS purifier, designed by Arthur Pennell, is made with a view to reducing to a minimum trouble and expense from the deposit of scale in boilers.

As is generally known, the mineral matter consists of 2 classes: First, that consisting chiefly of carbonate of lime and magnesia, which are nearly all deposited when the temperature of the water is 212 deg.; second, sulphates of lime and magnesia which begin to precipitate at 260 deg., and are nearly all thrown down at 300 deg. Addition to the water of a suitable amount of soda ash causes a reaction at temperatures below 212, so that the sulphates are changed into carbonates, and precipitated, leaving a soluble salt, or sulphate of soda.

The apparatus is shown in the accompanying cut, where the cold hard water flows into an open pan with perforated bottom and when necessary a trickle of a strong solution of soda ash is used. It enters at the top of the cylinder as shown down which the water falls in a shower and into the lower part of which exhaust steam enters through a branch from the main exhaust pipe. As the steam is condensed by the water shower, a considerable draft of steam is produced and this is controlled by a valve. The water the boiler feed pump it has become practically free from boiler encrusting matter and is at a high temperature. Water is supplied at such a rate as to keep the level in the tank constant by means of a float controlling a valve on the cold water pipe.

Results of treating Missouri River water are shown in the accompanying table, this test having been car- is heated by the exhaust steam, thus driving off most of the noncondensible gases, which pass off into the air through the outlet near the top of the cylinder.

In order to bring the temperature of the water up to boiling point, a small amount of live steam enters as indicated, and the hot water flows downward to the bottom of the tank, and rising through the tank permits of the mineral matter settling out and depositing on the bottom. The tank is made of such dimensions that before reaching the level of the suction pipe for



THE PENNELL HEATER AND PURIFIER

ried out with careful attention to keeping the rate of flow of water through the heater at the right amount for best results.

Copy of results of test with Missouri River water in parts per million:

Mineral.	Crude water.	Treated water.	
Silica (Si. O)	.20	0	Hardness tested by soap solution.
Calcium (Ca)	94	18	Crude Water: 21 degrees; treated, 5.
Magnesium (Mg)	28	6	
Sodium & Potassium (Na. & K)	68	119	
Carbonate radicle (HCO_2)	0	0	
Bicarbonate Radicle (HCO_3)	308	41	
Sulphate radicle (SO_4)	107	107	
Nitrate radicle (NO_3)	20	20	
Chlorine (Cl)	24	24	

APPLICATIONS OF LOW-PRESSURE TURBINES III

By Edwin D. Dreyfus

IN Fig. 10, the total steam line of C of the 750-kw. low-pressure turbine, is given, and also the corresponding intermediate pressure line E, one pound being added to the turbine inlet pressure for receiver drop. In addition, the total steam line, D, of a 1200-kw. Corliss compound d. c. engine unit is included, differing, however, from the customary representation in that it is plotted for constant output against the varying back pressure established by the bypass governing system from no load to full load on the turbine.

Manifestly, where lines D and C cross, the turbine is consuming the entire engine exhaust. To the left of this point, the disparity between the 2 shows the quantity of steam by passed, and to the right, the surplus steam admitted by the live steam valve to carry the overloads on the turbine.

Reduced to the unit water rate, the gain becomes very apparent, as shown in Fig. 11. The engine rate obtaining for blowing or d. c. units, with the average condition of maintenance, is about 20 lb. per kilowatt-hour, as indicated by the broken line H.

With a direct-operating governor admitting exhaust steam to the low-pressure turbine according to the load requirements, the atmospheric valve would be set to carry the peak on the low-pressure turbine, and consequently, at all loads less than rating on the turbine, part of the steam would be wasted. Obviously the economy of such an installation would not be so good as that obtained with the bypass system.

If a complete expansion turbine be installed to meet the power extensions, the average steam economy for the plant, with the engine at 1200 kilowatts and the turbine load varying, would agree closely with curve J.

Supplying a Direct Current Demand

NOT infrequently the power developed in the low-pressure turbine is to be consumed in direct-current machinery or special applications, such as electrolytic processes, etc. It is to be appreciated that direct-current generators are inherently slow speed machines, and are not adapted for direct coupling to turbines of 500 kw. and larger. Moreover, increasing

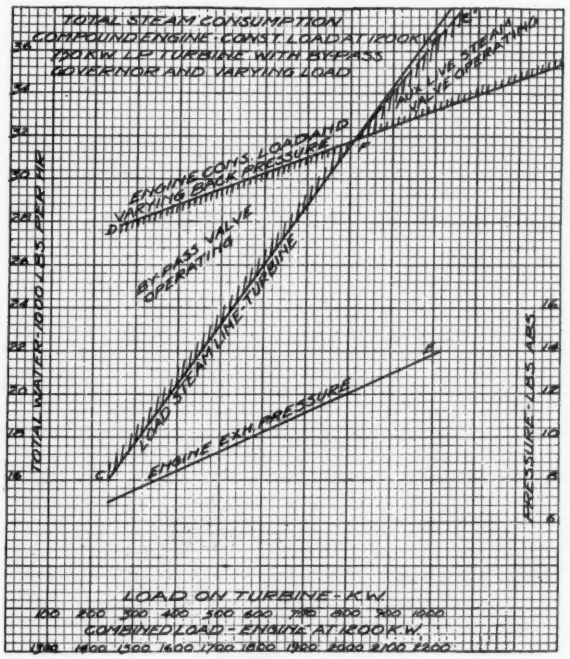

TOTAL STEAM CONSUMPTION
COMPOUND ENGINE CONST. LOAD AT 1200 KW
750 KW L.P. TURBINE WITH BYPASS
GOVERNOR AND VARYING LOAD
ENGINE CONS. LOAD AND VARYING BACK PRESSURE
BY-PASS VALVE OPERATING
LIVE STEAM TO TURBINE
ENGINE EXH. PRESSURE
TOTAL WATER RATE
PRESSURE-LBS. ABS.
LOAD ON TURBINE - KW.
COMBINED LOAD - ENGINE AT 1200 K.W.

FIG. 10. VARIATION OF STEAM USED WITH LOAD UNDER BYPASS GOVERNING SYSTEM

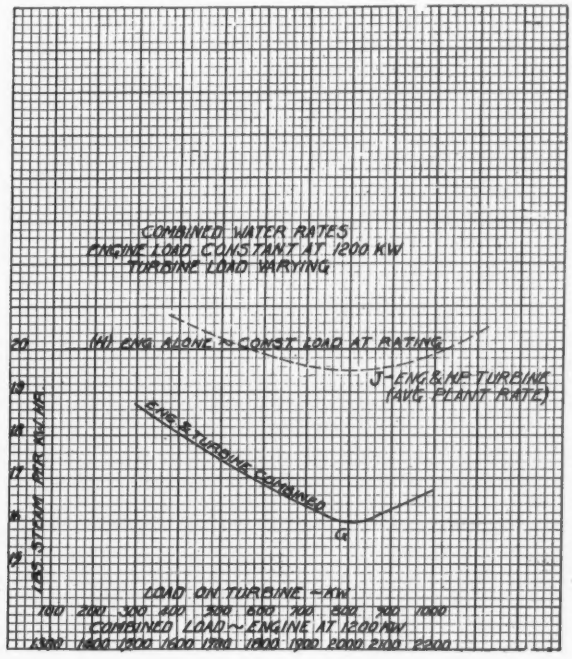

COMBINED WATER RATES
ENGINE LOAD CONSTANT AT 1200 KW.
TURBINE LOAD VARYING
(H) ENG. ALONE - CONST. LOAD AT RATING
J-ENG. & TURBINE (AVG. PLANT RATE)
ENG. & TURBINE COMBINED
LBS. STEAM PER K.W.H.
LOAD ON TURBINE - KW.
COMBINED LOAD - ENGINE AT 1200 KW

FIG. 11. STEAM CONSUMPTIONS PER KILOWATT-HOUR FIGURED FROM FIG. 10.

Curve G shows the equivalent combined water rate with variable load on the turbine, determined from the total steam lines D and FC, Fig. 10, the combined output being read on the lower horizontal scale. The improvement secured in this method of operation, is therefore, from 25 per cent at full load on the turbine, to approximately 10 per cent at half load.

If it had been assumed that the proposition would have demanded a larger low-pressure turbine capacity, the showing for combined operation with bypass governing would have been still more favorable.

d. c. generating speeds necessitates the highest degree of skill, material, workmanship and attendance to vouchsafe both satisfactory operation and economy.

There has, consequently, been an insistent demand for the employment of standard, direct-current apparatus, which has been satisfied through the use of turbo-alternator and rotary converter combinations and the Melville-Macalpine flexible reduction gear. Incident thereto, a substantial betterment in economy is derived, as Fig. 12 shows, in a system mechanically and electrically superior. A 500-kw. d. c. low-pres-

sure turbine unit with reduction gear, is presented in Fig. 13, and Fig. 14 shows the comparative floor space of a direct coupled unit,—both of 750 kw. capacity.

Intermittently Operated and Reversing Engines

AN important auxiliary for the low-pressure turbine has been devised in the steam regenerator and accumulator which averages the irregular supply of ex-

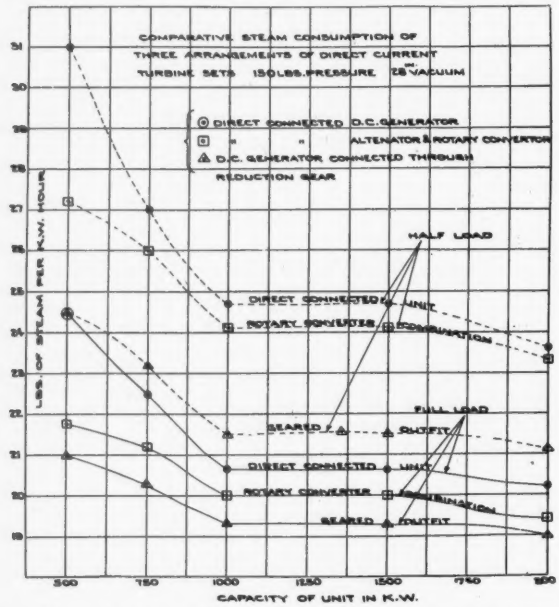


FIG. 12. STEAM CONSUMPTION OF DIRECT CURRENT TURBINE SETS

haust from engines, producing a fairly constant flow of steam to the turbine. The economies thus effected, are well known. The turbine is enabled to produce a constant output, and moreover, large quantities are prevented from being wasted on the heavy load on the engines.

Its practical use, however, is confined to periods of 3 min. and less, and the working range must be kept within 4 lb. to realize the desired results. The field of the regenerator lies chiefly with these classes of engines.

For constant running engines, the apparent advantage in relieving the pulsation of steam flowing to the turbine lies in possibly permitting a slightly smaller turbine to be installed and operated at more efficient load. This, however, is counterbalanced by the greater expense of the regenerator installation and its losses.

Periodic Cessation of Exhaust Supply

CONDITIONS may, at times, be encountered conducing toward the use of a low-pressure turbine with the exhaust supply interrupted for certain periods, and where the turbine must continue in operation. Such requirements have evolved the development of a mixed flow design, Fig. 15, possessing good economy with either high or low-pressure steam.

But the advantage of this type may be easily confused. The low-pressure turbine, as understood, may be installed without governor, with auxiliary throttling valve, or of mixed flow construction, containing a high-pressure element.

Evidently there are conditions obtaining in which any of the 3 arrangements may prove superior in practical operation. It is now well appreciated that the ideal application of the low-pressure turbine is fulfilled when it serves as a low-pressure cylinder of a reciprocating engine, with the machine stripped of unnecessary parts, regulator, governor, valves, or high-pressure elements.

Utilization of Gas Engine Waste Heat

SINCE the advent of the low-pressure turbine, it has become feasible to economize the waste heat of the gas engine in exhaust heaters and utilize the energy directly in the turbine without the introduction of high-pressure boilers and coal burning furnaces in the plant.

Based upon the actual performance of the component elements of such an amalgamated plant, the following results may be readily achieved: For continuous operation when employing the exhaust heat only, 6 to 8 per cent heat saving may be made over the existing economy of the gas engine; when abstract-

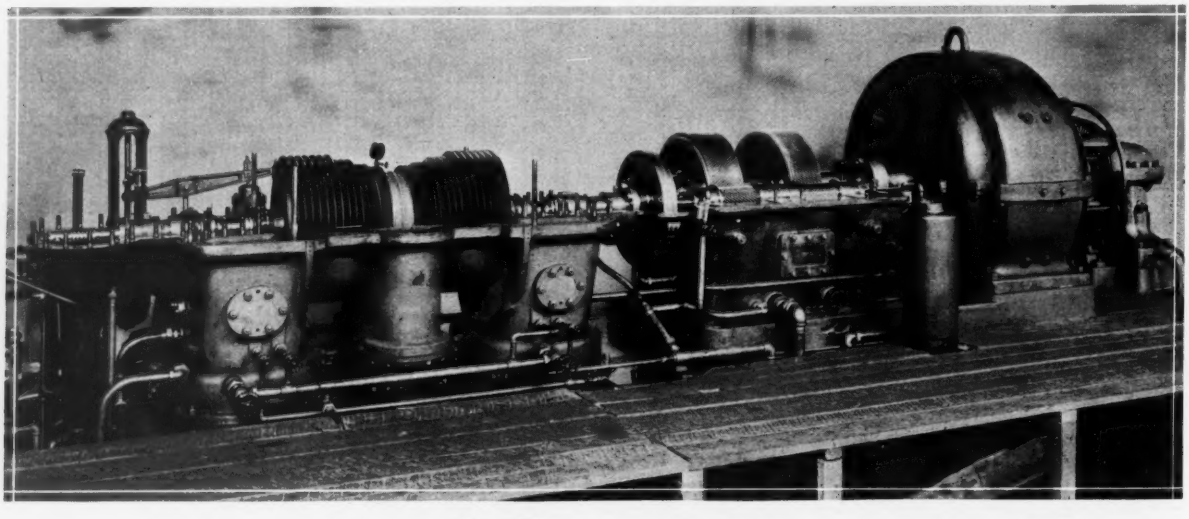


FIG. 13. 500-KW. GEARED D. C. UNIT

ing heat from both the engine exhaust and jackets, 10 to 14 per cent.

For peak load operation, storing heat from the exhaust over periods several times the duration of the peak, enables sustaining heavy overloads on the plant, resulting in appreciable reduction in investment for the maximum demand, 15 to 30 per cent normally, in addition to fuel saving. Operating with intermittent storage, the variable swings may be loaded on the turbine and the engine and producer operated under most favorable conditions. Ultimate improvement is about 15 per cent in heat consumption and 12 per cent in investment. Moreover, the auxiliary low-pressure turbine would act as a reserve unit to relieve, partially or fully, any temporary embarrassment of the engine.

If a widely changing load should be experienced, providing a low load factor, the installation of the auxiliary plant for continuous operation, may prove inadvisable, as the fuel expense may bear only a small relation to the total cost. But by accumulating the primary waste heat in a storage system and utilizing it in a simple and comparatively inexpensive low-pressure turbine auxiliary, this arrangement will lend itself to reducing the burdensome capital charges.

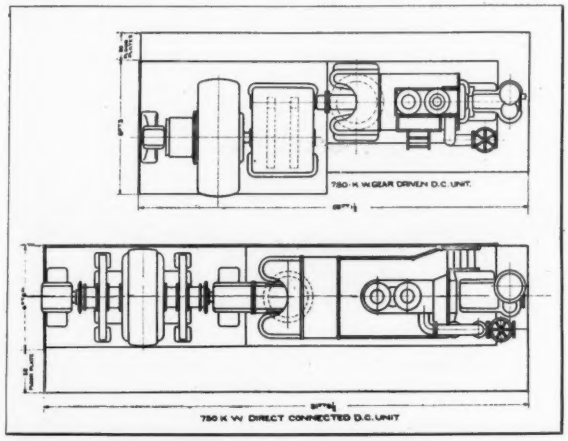


FIG. 14. COMPARISON OF SPACE NEEDED FOR 750-KW. GEARED AND DIRECT-CONNECTED DIRECT-CURRENT UNITS

Economy Records

A USER of the low-pressure turbine, of 300 kw. capacity, testifies: "The station factor was 34 per cent previous to the installation of the turbine, and 21 per cent since installation. Coal rate per kilowatt-hour for month previous to starting turbine, 7.37 lb.; for month following installation, 5.7 lb.

"This has been cut down to 4.4 lb. for one month's average lately under better load conditions.

"Reduction in complete cost for year's turbine operation, 7 months out of 12, 13 per cent. Do not have cost figured for shorter period than year.

"The turbine operates very satisfactorily on the exhaust of either engine or both, and governing is greatly improved on variable motor load."

A more comprehensive comparison of the improvement in power cost secured through the low-pressure turbine, is included in the following analysis of the records of a moderate sized central station. Months have been selected before and after the installation of the low-pressure turbine, in which the average output was practically the same, but, inasmuch as the addition of the low-pressure turbine has enlarged the rating of the plant, the comparison should have preferably been made with corresponding loading factors. It is, nevertheless, plain that there would have been a further reduction in operating cost, bringing the value of the low-pressure turbine out more prominently.

The fuel item has been reduced 34.2 per cent, but it must be remembered that the month including the low-pressure unit, was influenced by relatively inferior load factor.

There has also been a large decrease in the boiler room labor, viz., 47.8 per cent. It seems plausible that the economy of the boiler room should exceed the percentage reduction in fuel when it is considered that the overload capacity of a combined unit is obtained with very small increase in water rate while a noncondensing engine rapidly falls off on overloads. Consequently, greater preparation for peak loads is required for the straight engine plant.

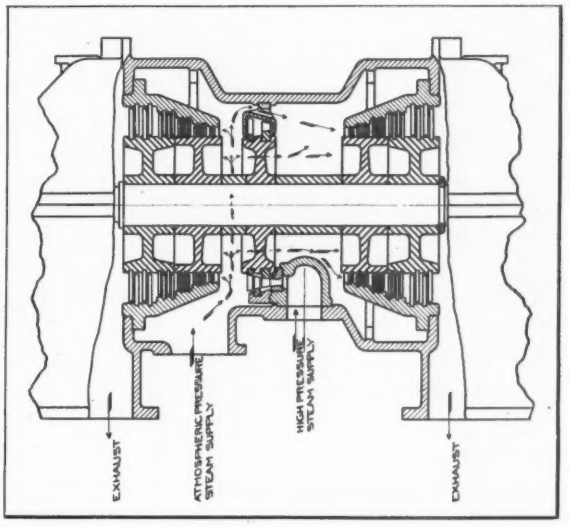


FIG. 15. DIAGRAMMATIC SECTION SHOWING STEAM PATHS OF MIXED FLOW TURBINE

Operating Costs Per Kilowatt-Hour

Month.	Sept., 1908	Oct., 1909
Total kilowatt-hours.	1,441,710	1,421,430
Fuel.	$0.004650	0.0030600
Boiler room labor.	.000930	.0004850
Engine room labor.	.000407	.0004830
Water.	.000160	.0001609
Oil, waste, etc.	.000029	.0000836
Repairs, steam.	.000309	.0000879
Repairs, electrical.	.000012	.0001408
General labor and repairs.	.000013	.0002300
Sundry expenses and supplies.	.000127	.0002300
Condensing apparatus repairs.	.000000	.0000000
Total.	0.006637	0.0049612

Regardless of the additional engine room machinery there has been no increase in engine room labor due to the simplicity of the turbine entailing but small attention. If the labor were based on an equivalent rating, it would, no doubt, be another credit item.

Taking into consideration the increased investment representing a net improvement of 19.5 per cent in over all cost has been obtained, regardless of the much lower load factor.

Efficiency Range, Engine vs. Turbine

WITHOUT involving intricate technical quantities, the theoretical value of the adiabatic expansion of steam between various limits may be appreciated from the temperature-entropy diagram, Fig. 16. These 2 factors constitute the heat content of steam analogous to weight and distance or pressure and volume, in work, or current and potential in electric energy.

From our standard steam tables, the line ak, Fig. 16, representing the heat of the liquid and cT, the saturation line, may be obtained. All other heat actions may be shown,—steaming along bc, obviously at constant temperature; cd, adiabatic expansion without giving up or receiving heat from an external source (which may be satisfied only by a vertical ordinate whose projected area is a point); and finally, da, exhausting at constant temperature.

Thus a heat cycle of searching nature is established of a value fully equivalent to that of the indicator card of the reciprocating engine. By including the line ef corresponding to the temperature of steam at atmospheric pressure, division of the energy available under

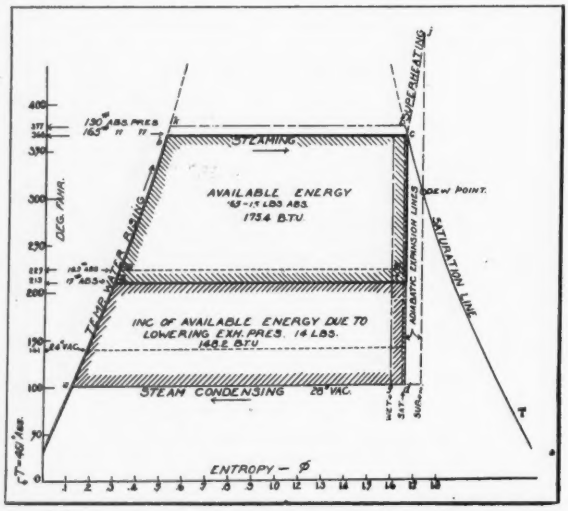


FIG. 16. TEMPERATURE ENTROPY DIAGRAM, SHOWING ENERGY AVAILABLE ABOVE AND BELOW ATMOSPHERIC PRESSURE

ordinary conditions above and below atmosphere is forcibly shown, emphasizing as it does the potentiality of steam at low pressure.

Due to the ability of the turbine to carry out economically the expansion of the steam to the lower potential limit, it has rapidly excelled in efficiency for low pressure service.

WESTINGHOUSE LOW-PRESSURE TURBINE

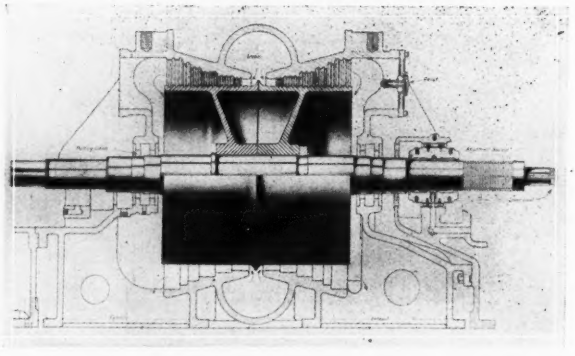
IN principle the Westinghouse low-pressure turbine does not vary essentially from the familiar high-pressure construction. Evidently the barrel must be made larger as the steam is only employed at atmospheric pressure. Furthermore, the design is simplified by arranging 2 similar elements which exactly balance each other, obviating the use of dummies, customary in the single-flow reaction turbine, for neutralizing all end thrust.

The interior portions of the casing conform to the several diameters caused by the various lengths of blades used in the rotor. Rows of stationary blades alternate with the moving blades of the rotor, serving to redirect the steam upon the latter. The casing is divided horizontally so that all working parts may be readily exposed by simply removing the cover.

The precise curvature and arrangement of blades are the result of both theory and experiments which have led to the present construction which is highly economical and efficient. The blades are so assembled as to admit of ease of repairs and by a caulking process, are held so firmly to the body of the rotor that they will pull in two before they can be drawn out by force.

Glands are provided at the ends of the casing or stator to prevent the escape of steam or the inflow of air to the turbine at the point of entry of the shaft. These glands are water-sealed and require no lubrication. For this reason it is impossible for any oil from the bearings or the lubricating system to find its way into the steam spaces. The quantity of water used for sealing the glands is negligible, but however, is not wasted as it is usually returned to the feed water system.

In turbines operating at relatively high rotative speeds, flexible bearings are employed in order to per-



SECTIONAL VIEW OF THE WESTINGHOUSE LOW-PRESSURE TURBINE

mit the spindle to revolve about its center of gravity instead of its geometric axis. The bearings consist of a nest of loosely fitting concentric bronze sleeves with sufficient clearance between them to insure the formation of oil cushions which absorb any small vibrations of the shaft that may exist.

In large sizes of turbines, and in fact for all machines running below 3600 r.p.m., the flexible bearing is not necessary. In this case a split self-aligning bearing, lined with anti-friction metal, is used, as in ordinary forms of moderate speed machinery.

Speed regulation is accomplished by means of an oil relay system consisting of a small pivot valve actuated directly by the governor and which controls the opening of the main poppet admission valve by varying the quality of oil under the operating piston of the latter.

Should the supply of low-pressure steam be insufficient to carry the load, an auxiliary live steam valve will bleed in the amount required to make up the deficit, ensuring continuous operation.

The governor is of the centrifugal type, the weight levers being mounted on knife edges to secure maximum sensitiveness. Variation of the turbine speed while in operation may be accomplished by proper adjustment of the main governor spring. This feature is particularly useful for synchronizing alternating current generators operating in parallel and for distributing the load between them when so operated.

POWER PLANT RECORDS

TO secure best operating conditions and highest economy in a power plant it is hardly sufficient to keep all the machinery in running condition and to know that the plant as a whole is making money. Large, well organized business concerns run each department independently of the others, separate accounts are kept which show at a glance which department is the most profitable, which the weakest, which needs strengthening, etc.

An example of how the same system can be carried out in a power plant has been in use for a number of years by W. L. Jackson, chief engineer of the First National Bank Building, Chicago. This is a well equipped isolated plant supplying an office building light, heat, power, elevator service, water, refrigeration, etc.

To begin with, each important piece of apparatus in the plant has an hourly log kept of its performance by the man in charge. In addition to this, when repairs or adjustments are made, the man doing the work makes out a time ticket, setting down just what work was done and the time required to do it.

CHICAGO_____ 191__

FIRST NATIONAL BANK BUILDING

HAVE FOLLOWING WORK DONE _____

_____

_____

AND CHARGE TO OUR ACCOUNT

ADDRESS_____ ROOM NO._____

SIGNED_____

NO WORK DONE WITHOUT AN ORDER.

WORK SLIP USED IN FIRST NATIONAL BANK BUILDING

Time Slip

Date

Name	Straight Time	Over Time	Cause of Overtime

Signed_____ Engineer

from_____ to_____

WORKMAN'S TIME TICKET

TROUBLE TICKET.

DATE _____

ROOM NO. _____

TIME REC'D _____ A.M. _____ P. M.

NATURE OF TROUBLE

MATERIAL USED

TIME O. K. A. M.	TIME O. K. P. M.	TIME PUT IN	REPAIRED BY

RECEIVED BY _____ PHONE _____ OFFICE

FORM USED IN CASE OF TROUBLE

REPAIR TICKET

DATE _____

MACHINE REPAIRED _____

MATERIAL USED

TIME PUT IN _____

SIGNED _____

BLANK USED TO RECORD REPAIRS

These logs and time tickets go to the chief engineer, who summarizes the results of the day for each machine and enters these upon the monthly report sheet. In another book, which corresponds somewhat to a ledger, an account is kept against each piece of machinery in the plant and all items chargeable directly to the machine are transferred from the time tickets to this book. These accounts consist principally of repair bills, time for making adjustments, packing, etc.

FIRST NATIONAL BANK BUILDING

ASH CARTAGE

DATE _____

CAR No. _____

TIME _____

SIGNATURE _____

FIRST NATIONAL BANK BUILDING

ASH CARTAGE

DATE _____

CAR No. _____

TIME _____

SIGNATURE _____

ASH CARTAGE TICKET WITH DUPLICATE

OILING SYSTEM.

Date_____

UNITS	Time	Oil in Glass	UNITS	Time	Oil in Glass
Rec. Tank No. 1			Rec. Tank No. 1		
Rec. Tank No. 2			Rec. Tank No. 2		
Filter No. 1			Filter No. 1		
Filter No. 2			Filter No. 2		
Filter No. 3			Filter No. 3		

Signed_____ Engineer.

A. M. to P. M.

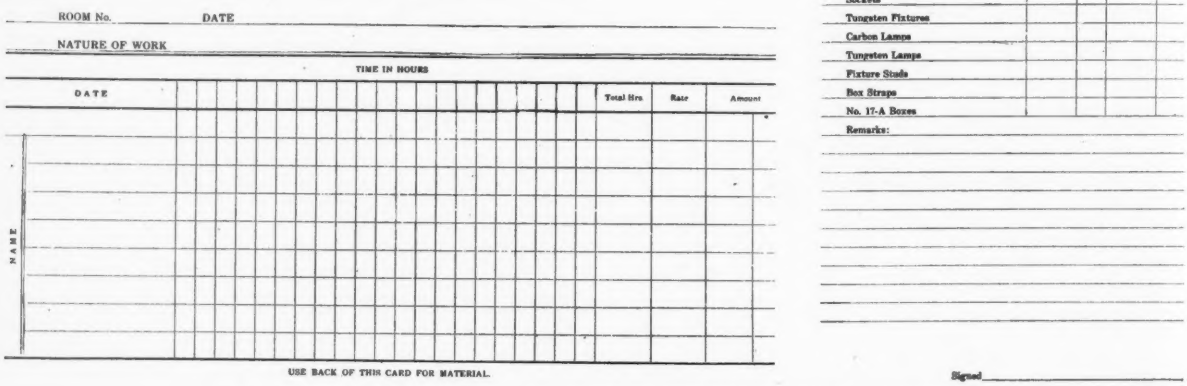
FORM OF OIL RECORD

At the end of each month a summary of the results is made, and the items of expense and the work of the plant for the various services are plotted upon the same sheet, the curves thus secured are compared with the previous months and the reasons for variations are studied with the idea of improving economy and the condition of

the plant. A curve for a winter month is reproduced here to show the method of laying it out.

A statement is made at the end of each year which itemizes the expenditures and credits, and the cost per kilowatt hour; everything charged to the switch board, is calculated. While this method of charging the switchboard with all expenses of the plant is somewhat unjust as compared with the load of a central station, for the reason that a power plant in an office furnishes elevator service, water, heat and exhaust and live steam, refrigeration—none of which employ electrical current—besides electrical power, so that this item compared with the same item of a central station is considerably higher. By this method, however, it is possible to compare plants of a similar class which furnish power for like purpose in about the same proportion.

The value of such a complete record can hardly be over estimated and the time required by the chief engineer in this plant to keep it up to date is about an hour a day. Aside from the yearly statement which shows the cost of producing power and other financial items in regard to the plant which are essential, the monthly reports on different machines show just where troubles have been encountered, the causes and expense to remedy them. The weak points in every piece of machinery soon make themselves evident and it takes but a short time to test out the value of various kinds of packing, oils and other engine room supplies.



FRONT AND BACK OF CARD RECORD FOR ELECTRICAL CONSTRUCTION WORK

The system enables comparison between boilers, generating units, pumps, and the like, that do the same kind of work. Likewise comparison of the efficiency of the men on the different watches can easily be made by the results obtained when this system of records is in use.

For the benefit of those who wish to adopt this system of records in their plants, a number of record sheets are reproduced herewith as a guide for making out reports and statements. In the following paragraphs are given summaries from the monthly reports upon different pieces of machinery taken during the month of April, 1911, and selected as being typical of the operation of the plant.

There are 5 boilers in the plant; report on boiler No. 2 follows:

In service, 30 days.

Safety valve popped, 0.

Banked, 172½ hr. total, or part of 21 days.

Remarks and repairs: Made upon feed-water regulating valve stem packing. Put in new gage glass with shield used, 4 rubbers.

Under head of remarks and repairs for other boilers in the plant, the following items are noted as indicating the operation of the plant: External and internal cleaning. Testing and inspecting. Overhauling feed-water regulating valve. Repairing bridge wall, using 5 3x12x12 tile.

Of the 5 engines in the plant, the report on No. 1 was selected and is as follows:

Hours run, total, 194 in 21 days.

Cylinder oil, 64¾ pt.

Kw. hr. delivered measured by watt hour meter, 25,545.1.

Electrical horsepower hours, 34,230.43.

Remarks and repairs: April 11, Keyed up all around. Setting up high pressure cross head shoes. April 21, Keyed up all around. Repairing lubricator and oil pipe.

Typical remarks made upon reports of other engines are as follows: Took off high-pressure side which ran hot. Keyed up. Packed right valve rod using ⅜ No. 910.

There are 22 elevators in the building and a record is made of each, that of No. 1 is as follows:

In service, 30 days.

Out of service, part of 3 days.

Remarks and repairs: Cleaned up pilot valve. Examined emergency brake on car. Repaired gate on main floor.

Some of the difficulties encountered in the operation of elevators are shown under the head of remarks and repairs for the other cars, a few of these items are as follows:

Put ¾x5 in. nipple in supply line to pilot valves. Repaired lock on 12th floor. Repaired gate on 12th floor. Took up gland on cylinder. Cleaned pilot valve; and centered lever. Set automatic buttons. Examined emergency brake on car. Ran car while inspector looked over cables and machines.

A summary of the report on the refrigeration plant is as follows:

Hours run, 318 in 30 days.

Condenser pressure, average from 165 to 170.

Back pressure, 6 lb. average.

Temperature drinking water, x.

Temperature brine, 3 to 9 deg.
Ammonia height in glass, 1 in. to 9½ in.
Remarks and repairs: Blew down cooler and separator. Renewed oil. Followed up on all glands of No. 2 brine pump. Keyed up No. 1 brine pump. Repaired chain

Switchboard Readings

DATE

	Dynamo No. 1		Dynamo No. 2		Dynamo No. 3.		Dynamo No. 4		Dynamo No. 5		Am. Trust	
	Am.	Volts	Am.	Volts	Am.	Volts	Am.	Volts	Am.	Volts	Am.	Remarks
1 A. M.												
2 "												
3 "												
11 "												
12 "												
Total Am.												

Total Am. Hours — Average Am. Hours

Total K. W. Hours — Reading Total Load Watt Meter

Total K. W. Hour out-put per Total Load Meter

Average Voltage

FORM FOR HOURLY SWITCHBOARD READINGS

belt on ammonia compressor. Blew down cooler and separator. Renewed oil. Keyed up main crank bearings on No. 1 brine pump. Emptied 1 drum ammonia into system. Purged condenser 4 hr. Repaired driving chain

Hours run, 250¾ in 25 days.
Cylinder oil used, 104 pt.
Remarks and repairs: Overhauled packing on joker and by-pass valve. Overhauled joker and by-pass. Followed up joker glands. Installed 4 additional studs in east low-pressure gland. Out of service, installing studs on east low-pressure gland. Overhauled steam joker, used 2 new cups. Followed up on by-pass gland. Installed 4 additional studs in high-pressure gland. Packed high-pres-

REFRIGERATING PLANT

DATE		Started	Stopped	Hours Run	Condenser Press.	Back Press.	Tempt. D. W.	Tempt. Brine	Ammonia Height in Glass	REMARKS AND REPAIRS	

ELEVATOR No. 12 Month of_____190__

DATE	In Service	Out of Service	Packed Raw	KIND OF PACKING	Cups Renewed	SIZE OF CUPS	Gen. Condition		REMARKS AND REPAIRS	

INSPECTED BY

REFRIGERATION PLANT RECORD SHEET
ELEVATOR BLANK RECORD

on ammonia compressor, using 1 pin. Repaired driving chain on motor. Repacked compressor piston rod, used ½ in. Garlock. Keyed up on Nos. 1 and 2 fresh water and No. 2 brine pump. Purged condenser 2 hr.

Of the 4 elevator pumps, the report of No. 2 is as follows:

sure plunger, used 1 in. Atlas flax. Installed 4 additional studs in high-pressure gland.

The boiler feed pumps are 2 in number. A summary of the monthly report on No. 2 is as follows:

Hours run, 252 in 12 days.
Cylinder oil used, 8½ pt.

Remarks and repairs: Followed up on gland. Followed up on piston rod glands. Closed suction and discharge valves. Inspected valves. Overhauled suction valves. Repaired governor. Packed water plunger both ends, used ¾ in. Skookum and Atlas flax. Packed east plunger, both ends, used ¾ in. Skookum and ¾ in. Atlas flax.

Report of No. 1 auxiliary pump is as follows:

Hours run, 328½ in 17 days. Cylinder oil used, 14½ pt.

Remarks and repairs: Packed piston rods, water end. Repaired drips. Overhauled discharge valves. Overhauled suction and discharge valves.

The coal and ash record for the same month is as follows:

Lb. coal, 3,190,000.
Lb. ash, 636,000.
Cost, $3776.21.
Watch, 12 to 8, 8 to 4, 4 to 12.
Live steam, hours for heating, 437.
Kind of coal, screenings.
Coal dealer, City Fuel Co.

In the daily report of the switch-board, readings are taken every hour for amperes and volts on each of the 5 generators, also a reading on the watt meter. Total

ENGINE No. 5 *Month of*_____*190*__

	Date	Hours Run	Cy'l Oil	S. W. Hours	Elect. P. Hours	REMARKS AND REPAIRS

BOILER No. 5. Month of_____190__

	Date	On	Off	Cy'l Oil	Safety Valve	Banked	REMARKS AND REPAIRS

COAL AND ASH RECORD. Month of_____190__

	Date	O. T.	Coal	Ash	% Ash	Cost	Ave. O. T.	Watch	Fireman	Engineer	Live Steam	Kind of Coal	Coal Dealer

VACUUM PUMP No. 2. Month of_____190__

Date	Hours Run	Cy'l Oil	REMARKS AND REPAIRS	

ENGINE BLANK RECORD
BOILER BLANK RECORDS
PUMP REPORT SHEET USED ON VACUUM, BOILER FEED, AUXILIARY AND ELEVATOR PUMPS

There are 2 vacuum pumps, the report on No. 1 is as follows:

Hours run, 336 in 16 days.

Cylinder oil used, 13⅝ pt.

Remarks and repairs: Overhauled. Followed up on glands. Overhauled valves and repacked pistons, using ½ in. X X X X hydraulic and ½ in. flax. Faced valves. Put in valves.

Coal consumption for the plant during the month of January, 1909, is itemized as follows (these values being used in plotting the curve shown):

Power load coal, 700 tons.
Heating system, 895 tons.
Live steam hours, 437 tons.
Kw. delivered, 156,800 in 31 days.
Ash removed, 318 tons.
Outside temperature, average, 34 5-31; min. -5; max. 64.
Lbs. coal per kw. hr., 17.69.

amperes for May 11 was 42,300; average ampere hours, 1762.5; the total kilowatts, 4864.5.

In addition to the reports on individual machines, the engineers and firemen in charge make a daily report upon the general condition of the plant and the work done. The items consist of notes on the routine work of the plant, such as inspecting valves and checks, blowing down boilers, blowing tube banks, bridge walls, etc.

In the yearly statement, which is given herewith, the expenditures are all itemized as are also the actual and assumed credits. Following these items comes a statement of the actual cost of heating, then a statement in regard to the cost of heating giving credit to the power plant for exhaust steam. From the above items a summary is made charging everything to the switch-board, and the earnings of the plant for the year are then calculated.

It will be noted, in this statement, that an average cost of 1 kw. hr. for the year is 4.7 cents, when everything is

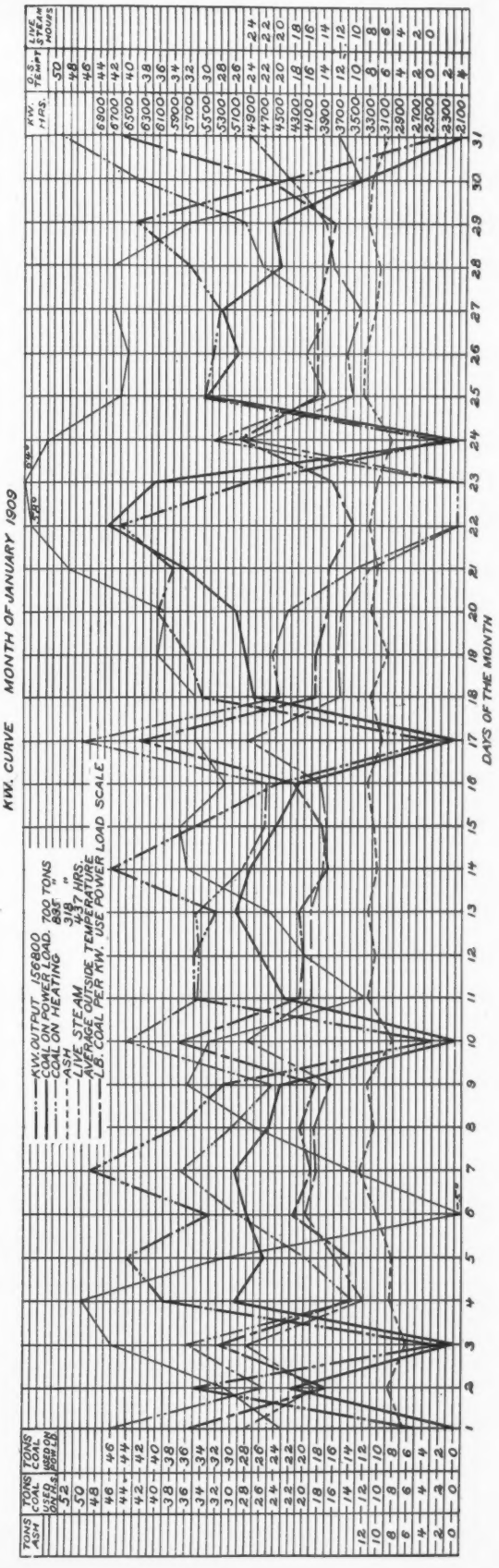
charged to the switch-board, which is an exceedingly low rate and is made possible largely through the accounting.

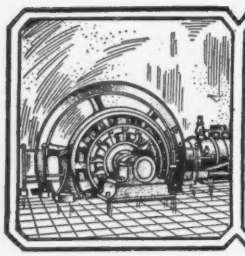
YEARLY STATEMENT FOR YEAR OF 1909.

Expenditures—	
Coal Bill	$36,607.76
Ash Cartage	2,236.80
Water Bill	2,049.65
Elevator Supplies and Repairs	2,210.72
Engine Room Supplies and Repairs	1,057.36
Boiler Room Supplies and Repairs	949.14
Electrical Supplies	1,471.09
Oil, Waste and Grease	1,566.73
Packings	569.93
Machine Shop Supplies and Tools	146.52
Refrigerating Supplies	421.25
Steam Fitting Supplies	472.88
Steam Heating Supplies	357.66
Plumbing Supplies	478.49
Lamps	2,037.34
Wages	28,815,72
Petty Expense	22.79
Office Expense	121.40
Coal Analysis	240.00
Dr. Bills	....
Electrical Construction Supplies	948.88
Total	$82,784.11

Actual credits consist of: Outside Building; Electric light and power, steam heating, steam power, steam on vacuum cleaner. First National Bank Building; Electric light and power, miscellaneous electrical receipts, miscellaneous plumbing receipts, miscellaneous steam fitting receipts, miscellaneous machine and shop receipts, junk, oil barrels, old lamps. Total amount, $71,572.85.

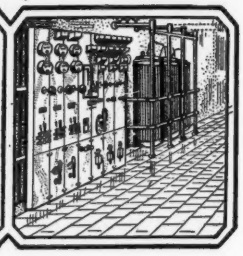
Assumed Credits—	
Elevator Service	$21,600.00
Steam Heating	21,249.96
Refrigeration	7,173.80
Pumping Water	700.80
Ventilation	2,354.40
Corridor Lighting	12,000.00
Steam on Kitchen	768.96
National Safe Deposit	4,999.65
Total	$70,847.57
Actual Cost of Heating—	
3974 Tons of Coal @ $2.25	$ 8,941.50
2038 Hours of Labor @ $ .88	1,793.44
Credit from Outside Building	1,544.87
Balance	9,190.07
Cost of Heating (giving credit to Power Plant for exhaust steam)—	
20,223,168 Lb. of Coal @ $0.11¼ per cwt.	$22,751.06
5,736 Hr. Labor @ $0.88	5,047.68
Credit from Outside Building	7,000.00
Balance	20,798.74
Summary: Everything Charged to Switch-Board—	
Lb. of Coal Burned	32,510,581
Kw. Generated	1,755,900
Lb. of Coal per. kw. hr.	18.17
Cost of Sup. per. kw. hr.	0.00901+
Cost of Labor per kw. hr.	.0164+
Cost of Coal per kw. hr.	.02084+
Cost One kw. hr.	.047+
Total Credits	$142,420.42
Expenditures	82,784.11
Earnings of Plant	$ 59,636.31


KW. CURVE MONTH OF JANUARY 1909
DAYS OF THE MONTH
KW. OUTPUT 156800
COAL ON POWER LOAD. 700 TONS
COAL ON HEATING " 88F "
ASH " 318 "
AVG. STEAM " 318 HRS.
AVERAGE OUTSIDE TEMPERATURE
LB. COAL PER KW. USE POWER LOAD SCALE
TONS ASH
TONS COAL USED ON HEATING
TONS COAL USED ON POWER LOAD
KW. HRS.
TEMP.
LIVE STEAM HOURS



Electrical Machinery

For Generating, Transmitting and Using Current



GRAPHICAL SOLUTION OF DIVIDED CIRCUITS

By J. M. Row

IT FREQUENTLY becomes necessary, in electrical work to determine the joint resistance of two or more conductors in parallel. This of course can be done by taking the reciprocal of the sum of the reciprocals of the different resistances; but this takes much valuable time which can be materially lessened by the following graphical method.

Draw a horizontal line XX, Fig. 1. Upon this line erect 2 perpendiculars as AB and CD, either by means of a right angled triangle or a pair of compasses. On AB, using any convenient scale, lay off a distance BE representing one of the resistances, and on DE lay off a distance DF representing the second resistance. Now draw BF and ED, and from their intersection G drop a perpendicular to the horizontal line as GH. GH measured by the same scale as previously used will give the joint resistance of the 2 resistances represented by BE and DF.

For example: Two resistances are 9 and 13 ohms respectively; find their joint resistance.

Assume a scale of ⅛ in. to 1 ohm, then making EB = 9/8 in. and DF = 13/8 in. By measuring GH it is found to be a little over ⅝ in., therefore the joint resistance is a little over 5 ohms. For greater accuracy it is only necessary to use a larger scale.

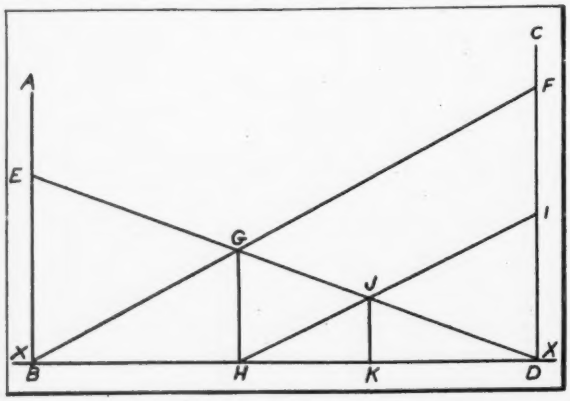


FIG. I. FINDING RESISTANCE OF DIVIDED CIRCUIT OR LINES IN PARALLEL

In the above problem, suppose a third resistance of 7 ohms is to be used and the joint resistance of the 3 is to be found. After going through with the preceding steps, lay off on CD a distance ID = ⅞ in. and draw HI. At its intersection with ED as at J drop a perpendicular to the horizontal line as JK. JK represents the joint resistance of the 3 given resistances, and as it measures ⅜ in., the joint resistance is 3 ohms.

Again it might be desired to find the value of a resistance which when placed in parallel with a given resistance will give a predetermined joint resistance.

For example: What resistance when placed in parallel with 7 ohms will give a joint resistance of 4 ohms?

Solution: Draw AB and CD perpendicular to XX, Fig. 2. Using the same scale as in the foregoing problem, lay off EB = 7 ohms, and FD = 4 ohms. Draw EF and prolong until it intersects XX as at H. Draw

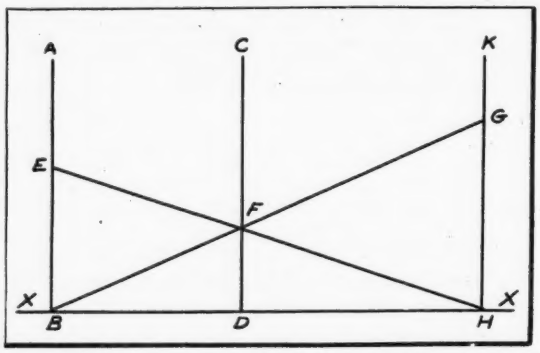


FIG. 2. FINDING SHUNT RESISTANCE REQUIRED TO GIVE REQUIRED TOTAL RESISTANCE OF CIRCUIT

HK perpendicular to XX, and through BF draw a line intersecting HK as at G. By measurement GH = 9/8 in., which represents 9 ohms. This is the resistance which, when placed in parallel with 7 ohms, gives a joint resistance of 4 ohms.

DOCTORING SULPHATED STORAGE BATTERIES

WRITING of this subject, J. O. Hamilton gives in the Electrical World a process of treatment at Kansas State Agricultural College, which has given good results.

When a cell is brought to the laboratory for treatment, the operator first examines the contacts of the cell, as the formation of an oxide covering the lugs and binding posts is often found to be the real seat of trouble in a defective cell; all nuts, washers and binding posts are removed and given a thorough cleaning, scraping or filing, to be sure of metallic contact. The cell is charged until gasing starts, after which it is discharged at the usual rate to 1.8 volts, and again charged to its rated ampere-hours, observing the current and time of charge, and is finally discharged, observing the ampere-hours output and calculating the efficiency.

Under these conditions if the acid is of nearly usual strength, the plates having been previously examined to be sure that no short-circuits exist, and if the efficiency falls to 50, 40, 30 per cent or lower,

the cell may be taken as slightly or badly sulphated as the efficiency test may show.

In treating the sulphated cell, the acid solution is siphoned off in case of a large cell, or poured off in the case of a small one that can be easily handled, and the plates thoroughly rinsed or soaked in distilled water, or rain water, which is again drained off. A solution of caustic soda (NaOH) of a strength running from 2 to 5 per cent by weight, is poured into the cell, using enough to cover the plates, and the battery put on charge, charging in the usual direction and at the same rate.

If at any time the solution gives an acid reaction on litmus paper and the sulphate at the positive plate has not disappeared, add caustic soda to the solution until a positive alkaline reaction is given and continue to charge until the plate has the usual chocolate appearance. Draw off the solution, rinse the plates, pour back the sulphuric acid solution and continue the charge until gasing starts, or until the drop shows that the cell is fully charged.

If one is certain that the cell is sulphated, start at once with the caustic treatment. The preliminary steps were given only that the user might test for himself the efficiency of the method by testing the capacity of cell before and after the treatment.

Cells that gave on repeated test as low as 20, 23, 25 per cent efficiency have been brought up to 70, 75, 80 per cent of charging capacity with a treatment not exceeding 6 hr. duration, and at an expense of only a few cents; caustic soda, such as is used with any of the caustic soda primary batteries, was used. So far no cell has been treated that did not respond readily to the treatment and in all cases where the cells have been kept in use in the laboratory none have shown bad effects from the treatment, although some of them were treated 4 years ago.

It is found that independent of how badly the cell may be rotted, if there is enough of it left to hold the parts intact, the cell is well worth the cost of renewal, and that no storage cell need be thrown away on account of being sulphated.

NEW GENERAL ELECTRIC COMMUTATING POLE MOTOR

SEVERE service that electric motors are called upon to perform in many industrial power applications, and the consequent necessity for reliability and efficient all-day operation, requires the use of machines possessing exceptionally good commutation, overload and heating characteristics, combined with great mechanical ruggedness. The type CVC commutating pole motor just brought out by the General Electric Co. has been specifically designed to meet such requirements.

The reason for being of commutating pole design may be readily understood if it be remembered that sparking under the brush of a non-commutating pole d. c. machine is almost wholly due to the absence of a magnetic field, automatic in action and of sufficient intensity to reverse the armature coils successively short-circuited as corresponding segments pass under the brushes.

The commutating poles of CVC motors are connected in series one with another, and also with the armature; their magnetizing power is, therefore, in proportion to the armature current, and may consequently be employed to compensate for armature reaction, allowing sparkless commutation over wide ranges of load and under adverse conditions of operation.

In addition to the above, commutating pole motors allow a wider range of speed control by field than is permitted with motors of non-commutating pole design. Due to freedom from sparking, heating of commutator and brushes is reduced, minimizing attention and repairs, and greatly increasing the life of these parts.

Due to reduced deposition of carbon and copper dust by wear, commutator and brush parts of these motors permit great cleanliness

The speed curve of the motor shows a flat characteristic, an important consideration especially where

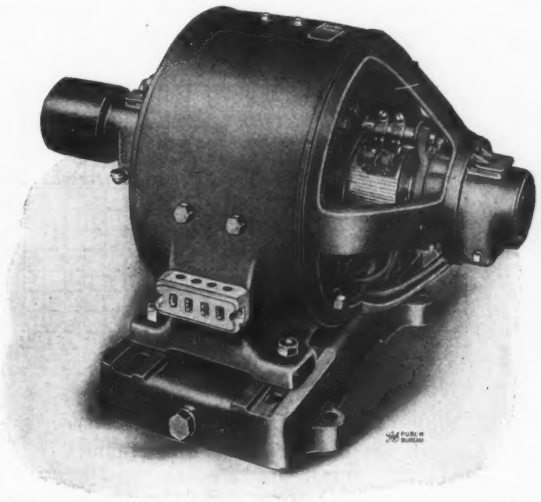


FIG. I. C V C MOTOR FOR 3-H.P. CAPACITY

driven machines must, even under overload, be kept at normal speed to sustain production.

Internal ventilation is secured by a simple, rigid and durable form of fan mounted on the armature shaft within the pulley end bearing head. This fan, while consuming a negligible amount of energy, in-

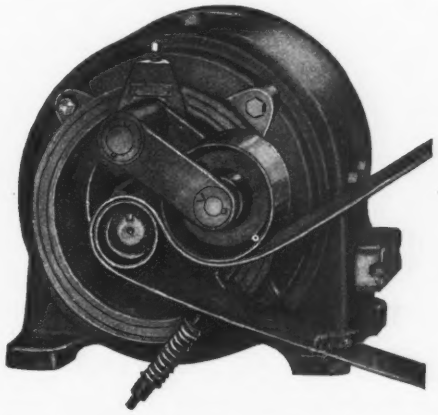


FIG. 2. MOTOR WITH BELT TIGHTENER ATTACHMENT

sures cool operation under very severe conditions of temperature and load. Internal ventilation has been advantageously applied to transformers, motor generator sets, etc., for a number of years. A similar application in motor practice is entirely logical, natural, and in step with the most advanced engineering practice.

The main field coils are wound on strong horn fibre spools, amply insulated with pressboard, mica, varnished cambric, etc., to insure freedom from breakdown under possible excess potential strains. The windings are rendered moisture-proof by thorough impregnation with a special insulating compound. Before final assembling the coils are armor-wound with a single layer of enamel-covered wire, serving the double purpose of protecting the active windings from mechanical injury and assisting to a higher degree of heat radiation.

The commutating poles are wound with rectangular copper wire, the coils being assembled on horn fiber spools, which thoroughly insulate the coils from the pole pieces.

Special pains have been taken so to design the commutator that complete immunity will exist from

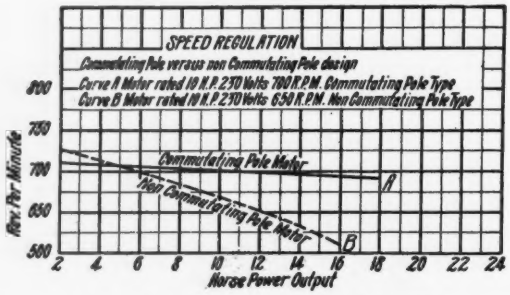

SPEED REGULATION
Commutating Pole versus non Commutating Pole design
Curve A Motor rated 10 H.P. 230 Volts 700 R.P.M. Commutating Pole Type
Curve B Motor rated 10 H.P. 230 Volts 650 R.P.M. Non Commutating Pole Type
Rev. Per Minute
800
750
700
650
600
Commutating Pole Motor
Non Commutating Pole Motor
A
B
2 4 6 8 10 12 14 16 18 20 22 24
Horse Power Output

FIG. 3. SPEED CURVE OF C V C MOTOR

loose or high bars. The commutator bars are insulated from one another and from the commutator shell by selected sheet mica, micrometer gaged to a uniform thickness and of proper hardness to wear down evenly with the copper. The outer corners of the segments are rounded to prevent chipping of the mica and the inner edges are notched out to prevent short-circuiting between the bars. There are small grooves in both the flat sides of the copper segments which serve, when the commutator is hydraulically pressed in its assembly ring, firmly to anchor the mica insulating segmnts, thus avoiding the possibility of high mica.

The bearing heads being interchangeable, the relation of the terminal block to the commutator and pulley end heads may be shifted by removing the heads, turning the armature end for end and finally replacing the heads to correspond with the reversed armature position. It is thus possible to have the terminal block accessible under varying conditions of installation.

The bearing linings are large, and thorough lubrication is ensured by the use of heavy oil rings of generous cross section.

All bearing brackets and frames are drilled and tapped symmetrically so that motors may be readily arranged for sidewall or ceiling suspension by turning the bearing heads 90 or 180 deg. respectively with relation to the frame.

Many other important improvements in minor electrical and mechanical details of design and construction ensure for the completed CVC motor the possession of exceptionally desirable mechanical and electrical characteristics.

WHERE OIL WILL not act as a cooling agent on a drill working in hard metals, turpentine used instead will permit the drill to take hold and retain its temper.—Popular Mechanics.

GROUP VS. INDEPENDENT DRIVING BY MOTORS

WHEN driving of machinery by electric motors was first introduced, the most radical advocates of the system took as a slogan "a motor to each machine," while the more conservative members of the craft argued for a motor to drive each group of machines through a Jackshaft. At that time the range of motor speeds available made it well nigh imperative to use the group method. Now, however, any motor speed desired can be secured even in small sizes, and it becomes not a question of what one can do but of what is best to do.

In an issue of Electric Traction Weekly is summarized the advantages of the 2 methods concisely. Independent drive gives increased output; a saving of power used up in shafting, belting, etc.; a saving in the labor necessary to shift belts and to care for belts and shafting; freedom of placing machines; increased light; freedom from dust and dirt; and saving in the cost of shafting and belts. Also any machine or any machines not near together may be operated overtime when necessary without running idle shafting or machinery.

In favor of the group drive is the reduction in first costs of the tools and a lower cost of motor equipment, which altogether amounts to about 15 per cent. Experience has proved that a reasonable compromise between the 2 extremes of the motor for each tool, and group drive for all tools is the use of a motor for each large tool and the grouping of small tools of like character, such as screw machines, small multiple spindle drills, milling machines, etc.

BUSINESS SCIENCE IN BIG PLANT

IN the new plant of the Keystone Lubricating Co. at Philadelphia, scientific management has been carefully incorporated. The enterprise has grown to such proportions that the new plant covers an area of about 100,000 sq. ft., and every detail of construction and systems has been carefully studied to form part of a harmonious whole in which clean and healthful surroundings, safety devices, cheerful environment and economy of production are combined to reach the highest standard of efficiency. Scientific management has been here embodied as an actual fact, and has proved on all accounts satisfactory.

The building was constructed with a view of obtaining a plentiful supply of natural light and ventilation, giving a daylight plant. On the ground floor are manufacturing, storing and shipping departments, while the executive department is separated from the rest of the plant and is located on the second floor, the offices here being arranged to give plenty of light and air. Three large storage tanks are provided for oil, each having a capacity of 1000 barrels, and for purposes of safety being located in an underground vault, electric lighted and built of concrete and fire-proof. The receiving and shipping platform, which is one of the finest in Philadelphia, is protected by a roof running the entire length. As a provision for the comfort and health of its employes, the company has arranged bright and cheerful dining-rooms, one for the workers in the factory and a similar one for the use of officers and heads of departments. The officers of the company whose faith in the adoption of a scientific management, is already justified by a large increase in business, are General Manager A. C. Buzby, Assistant General Manager H. A. Buzby, Manager of Credits and Collections W. F. Buzby.

WHERE VALVES ARE MADE

PLANT, EQUIPMENT AND PROCESS OF MAKING NELSON VALVES

NEAR Chestnut Hill, Pa., at Wyndmoor, a suburb of Philadelphia, are located the new works of the Nelson Valve Company. This location is ideal from every point of view—convenient access is had to Philadelphia for business service; Nelson Station is located alongside the plant for easy shipment in of material and out of finished product; large open space gives plenty of good air and light for employes and room for expansion of the plant; and frequent, well timed train service meets the needs in going to and from work.

Based on long experience in making high grade valves, the buildings in general plan, arrangement and detail have been designed to secure the best conditions for comfort, economy and efficiency. Walls and framing of buildings are of concrete and steel, with plentiful window lighting or skylights. Roofs are of concrete slabs.

Steel sash with wire glass complete the fireproofing and roof ventilators provide circulation, which insures fresh air and comfortable temperature. That ample capacity for a large output has been planned is shown by the total floor area, 110,556 sq. ft. in all buildings, by the steel foundry, which can make 16 tons of castings a day on 2 shifts, and the brass foundry, which can handle 20 tons a day on 2 shifts.

Modern methods prevail throughout the plant. In the finely appointed office of General Manager Carlisle Mason is a Hahl pneumatic master clock which controls all clocks in the plant, making correct time certain.

The general office, adjoining, is arranged in departments—cost, sales, purchasing, treasurer's—each in charge of a competent head, each complete in itself but convenient for consultation with each other or by the general manager. Directly below the treasurer's office is that of the paymaster, to which the weekly payroll is lowered by a well protected dumb waiter.

Patent and engineering departments are near by but divided from the general office so that those working on improvements and designs may be undisturbed. The patent department cares for preliminary details of design, patent specifications and papers, while in the engineering department full sized details can be worked out on drawing board, or for the larger valves on a mammoth blackboard, tracings made, and blueprints taken by electric process.

Every workman, entering past the paymaster's office, records his coming and going by the time clock, securing regular attendance and fair payment for time actually worked.

Power House

THIS is shown in the illustration, which gives an idea of the fine lighting and ventilating as well as the installation. It is a plant which in its modern

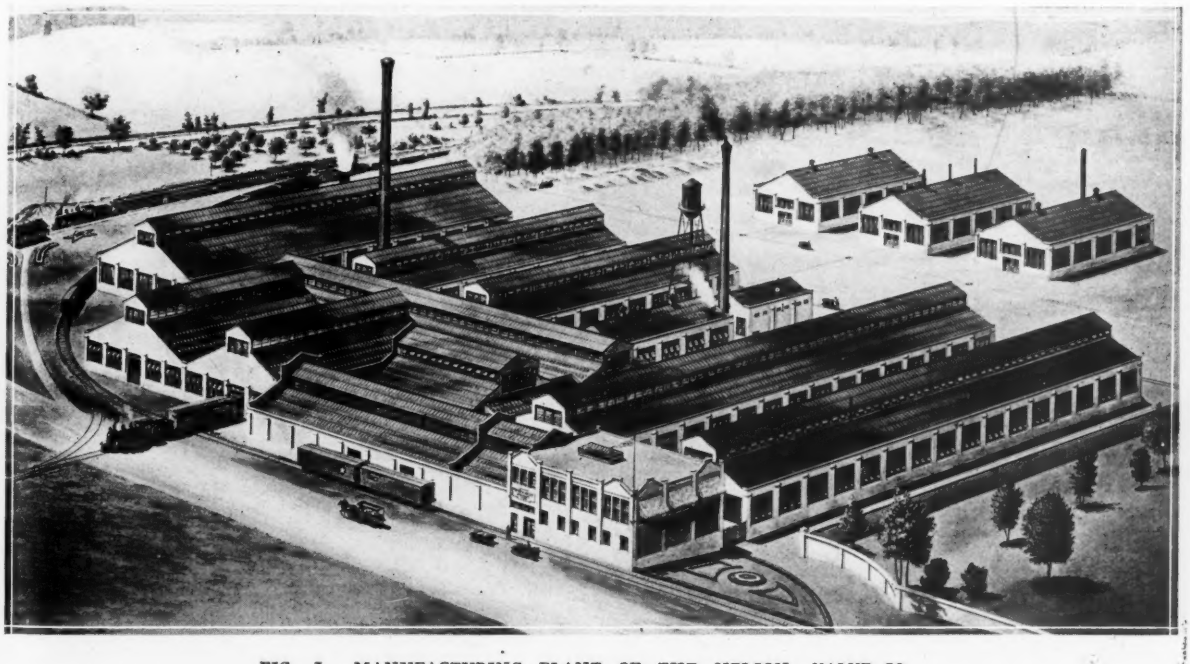


FIG. I. MANUFACTURING PLANT OF THE NELSON VALVE CO.

machines, ease of handling and security from trouble is a delight to the engineer.

Casting and Machinery

STORAGE bins for coke and sand, for Lake copper, Straits tin, Prime Western spelter and lead are so placed that supplies are unloaded direct from the track, yet are close to the moulding floors and furnaces so that no labor is wasted in the handling. The storage capacity for nonferrous metals aggregates 500,000 lb., reaching a value of $75,000, which, naturally, is kept under lock and key and carefully weighed out as wanted.

Physical tests of the metals used are made in the laboratory both before and after casts are made; and

in the chemical laboratory close analyses are taken of the iron, steel, copper, tin, coke and coal, giving actual knowledge of all materials used and alloys made.

Patterns for castings come from the master pattern shop, which is separated from others by fire-

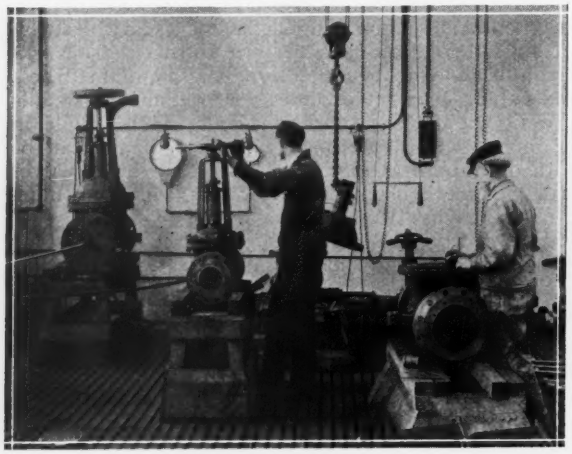


FIG. 4. TESTING LARGE VALVES

proof partitions with steel doors to prevent loss by fire of the valuable patterns which represent years of development, thought and skill.

Wood patterns are made of mahogany to give freedom from shrinking and swelling and smoothness of castings. For the smaller parts, of which thousands of duplicates must be produced, metal patterns, generally in gangs, are made in the tool making department, because the same high grade of skill is desired as for tools so that all valve parts may be accurate and interchangeable.

All patterns are stored in a vault provided with steel racks and adjustable shelves, with rolling ladders to give safe and convenient access.

Cores for the bronze foundry are made by girls who force the specially prepared sand into metal moulds, then take out the special shapes, which go on trays to the core oven for baking and then to the storage racks. All tables and chairs are of steel, again guarding against fire loss; light and air are liberal, air ducts in the girders providing heat in winter and cool air in summer.

In handling the metal, it is melted in crucibles, previously prepared in annealing ovens; then the furnaces are tilted to flow the metal into ladles which

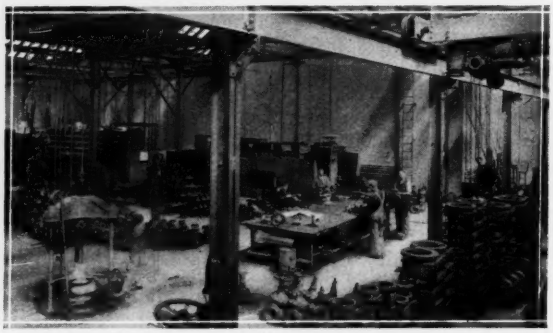


FIG. 5. ASSEMBLING AND TESTING VALVES

are carried by an overhead tramway to the point where moulds are to be poured.

Mumford, Tabor and Berkshire automatic moulding machines are used, the last being capable of making 60 moulds an hour.

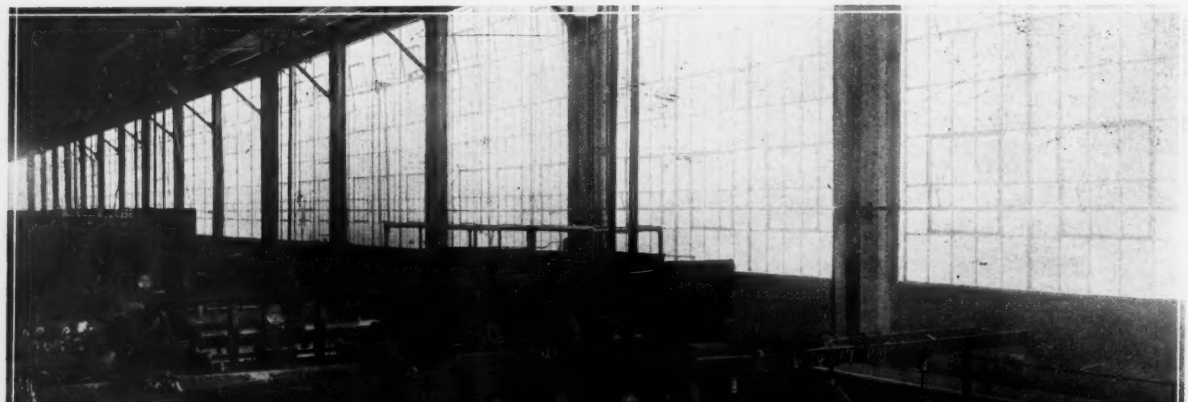


FIG. 2. SECTION OF TESTING DEPARTMENT

After being knocked out of moulds, bronze castings are sandblasted clean, inspected and taken to the bronze machine department, where they are rapidly yet accurately bored, faced, threaded and finished. Every facility is provided the machine operators—air chucks grip the pieces firmly or release them without stopping the machine; belts are shifted by quick-change pneumatic shifters; jigs and special tools are furnished for all operations.

Placed in steel tote boxes, the finished parts are stored on steel racks to await assembling in large batches, most of this work being done on pneumatic vises which grip firmly but do not mar the bodies.

Bronze Testing Department

NOTWITHSTANDING the fact that all the metals used have been carefully analyzed, and every part inspected both before it leaves the bronze foundry and in its progress through the bronze machine shop, then again inspected when assembled, it is possible for a flaw or weak point to remain unnoticed when the valves are practically complete. Here the testing tables show the final proof. Each valve is subject to a hydrostatic test that is more than twice as severe as the valve will have to stand after it is sold. The test finds the flaws. Whatever faulty valves are found are scrapped.

Throughout iron and steel foundries and the corresponding shops, the same orderly provision for effective work and safeguarding against fire prevails. Moulding machines, traveling cranes, motor drive for sections of shafting and for machine tools, iron overhead walkways, hangers carried on channel irons and girders, steel benches with tool drawers for individual workmen, revolving japan ovens which bake on one side while unloading and loading on the other,—all these make for efficiency and security.

From pig iron yard to testing room the progress is forward,—to cupola, to foundry, to cleaning room, to machine shop, to assembling room, to testing machine,—always forward, never retracing a step. And after successful test, a trip of only 20 ft. places the completed valve in the shipping room for crating and delivery.

Steel valves follow a similar course, but through different foundries and shops. In casting these valves, it is necessary, in order to secure sufficient density to withstand the severe usage on superheated service, to use immense headers, thus letting the metal cool under high pressure. And after cooling the castings are put through a heat treatment which further refines the grain and toughens them.

In the assembling department, the workmen gather the separate parts into a completed unit, then test the operation by frequently opening and closing the valve; and finally apply the hydraulic test for tightness of disc. The pressure used in this test, for a valve intended to work at 400 lb. pressure, is 1000 lb., the pressure throughout the test being recorded by a large gage so that any wavering or failure to hold full pressure is shown.

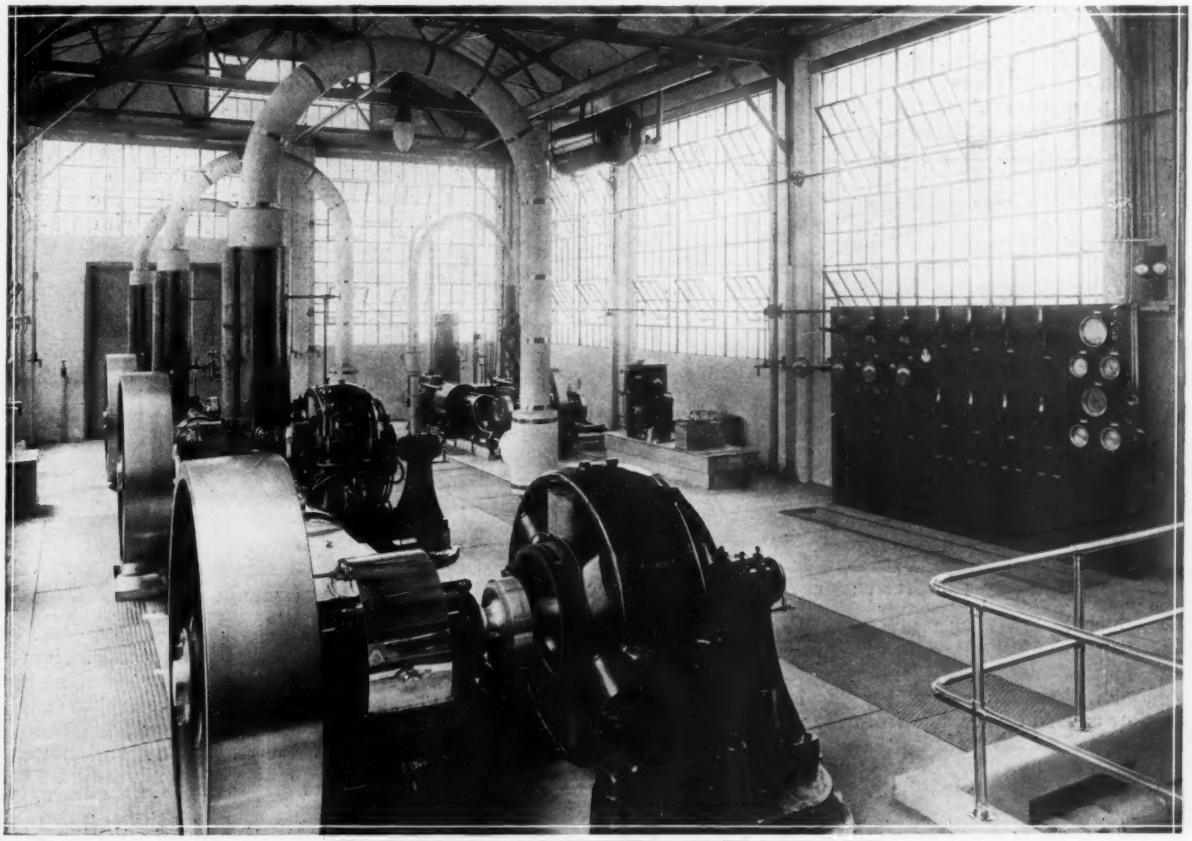
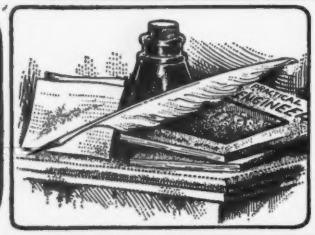


FIG. 3. ENGINE ROOM OF THE NELSON VALVE CO. PLANT

As such valves are intended for use with superheated steam, a long condensing chamber is provided to permit of safely repacking when in service, thus giving the valve unusual height.

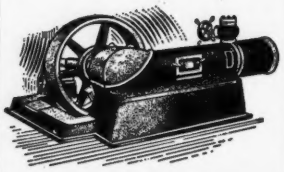
As orders are received, valves are taken from storage to the packing room for crating, this room being separated from the rest of the plant by fire walls and underwriters' doors.

With the crating completed, the elevator carries the valve up a concrete shaft to the shipping platform at car door level, where Mr. Valve says "Goodbye" to his birthplace and is trundled aboard a car en route to his new abiding place and a long life of service.



Letters from Engineers

Bright Ideas direct from the plant. Send us yours. Cash paid for those accepted. Sketches desirable; we make the drawings



A DRY KILN PROBLEM, AND OTHERS

WE have some dry kilns heated by exhaust steam, which are 90 ft. long and 30 ft. wide, 3 abreast, or 90 by 90 ft. total on the ground. Number 1 has 156 1-in. pipes and Nos. 2 and 3 have 146 each. In each kiln are double tracks and they are supposed to dry 50,000 ft. of 1-in. lumber daily. Now the 3-in. steam supply pipe runs along the outside of No. 3 kiln, clear to the back end, and is covered with a plank box which is filled with sawdust. Why not put the pipe inside the building and get some use of the heating surface?

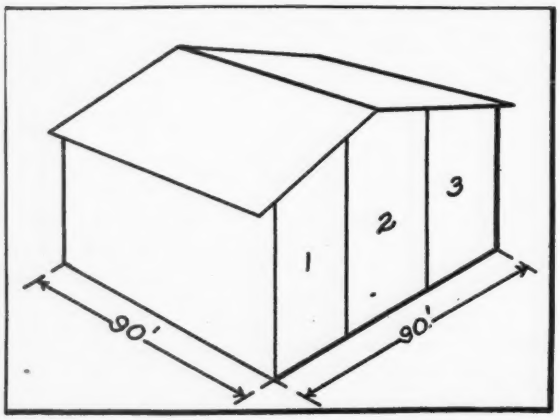


FIG. 1. ARRANGEMENT OF DRY KILNS

Under these kilns is a regular lake of water all the time caused by seepage from the mill pond. Would this have much effect on heating the kilns? Would there be a saving if these kilns were properly drained. We have nothing but condenser coils and let the steam and water go to waste, except what little is used in warming the feed water. We have no pump, so that we cannot use all the water coming from the kilns. We are now burning green fir slab wood at night, and as the bark is very dirty we have much trouble with clinker and a set of bars will not last a year. I have used a set of grates continuously for 5 yr. when burning clear sawdust and shavings.

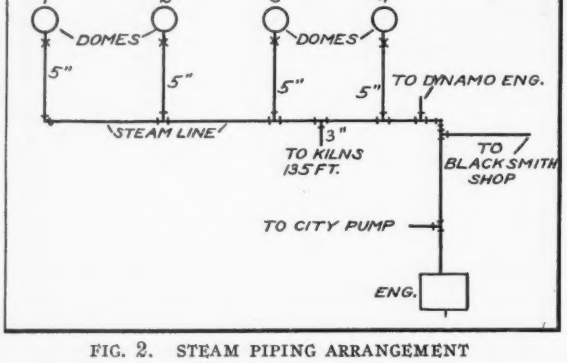


FIG. 2. STEAM PIPING ARRANGEMENT

Now, I believe, that by installing a good pump and using all the water from the kilns, I can save 1/3 of the shavings and dust and that will run 2 boilers at night. If this is so, the saving of grate bars will more than pay for the pump.

The kilns are supposed to be held at 180 deg. F. and that is a hard proposition at night when we cannot use water more than 100 deg. through the injectors. Each boiler has a separate injector with 1¼-in. fittings on the pipe connection. I notice that Nos. 1 and 2 injectors will not hold up in the forenoon. Numbers 1 and 2 boilers are working all the time, night and day; Nos. 3 and 4 are used only in the day time, and the injectors hold them up nicely.

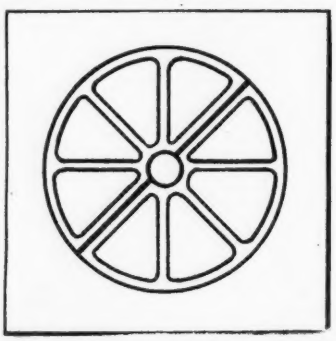


FIG. 3. FLYWHEEL WHICH WOBBLES

The chief says that there is nothing the matter with the injectors, but I claim that Nos. 1 and 2 are using more water because the furnaces are much hotter by being used all the time. We are carrying 100 lb. gage pressure on the boilers with engines cutting off at ¾ stroke. I would be pleased if someone who has taken interest in the exhaust heating problem would kindly make a drawing of a back pressure valve and other fittings to be fitted into this system.

Here are a few questions which I would like answered.

Why are the feed holes on tops of Dutch ovens made round? It seems to me if they were square it would be much easier to brace them with wedge brick.

If the gate valve connecting a boiler with a steam line leaks enough to show 40 lb. pressure on a dead boiler, will the cold air passing underneath and through the flues have any bad effects on the boiler?

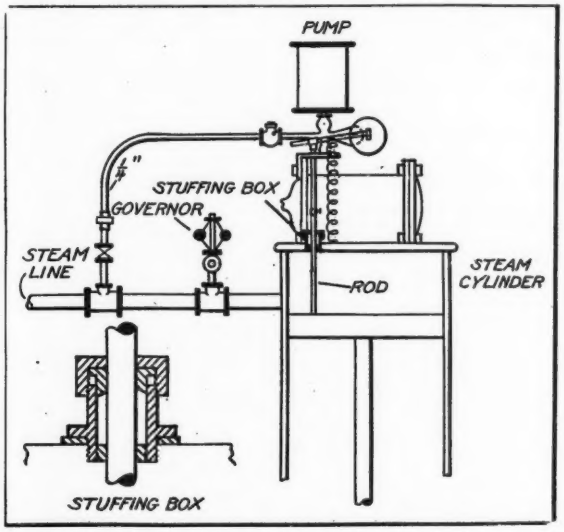
We have a 12-ft. flywheel running 125 r.p.m. and it has a side wabble of ½ in. The face of the wheel is 32 in. and on one side of the shaft we put 2 pieces of tin clear through between the shaft and hub, and could work them around easily on the key side.

Would you consider this safe? I think that the key is too high, but the chief says, "She's all right, let her go." The wheel is cast iron and touches the shaft only about 2/3 the way around. Charles Burns.

OIL PUMP LUBRICATOR

HEREWITH is a sketch of an oil pump working on an air pump which is more positive in action than the one I described some time ago.

There is a hole in top of cylinder cap which is tapped for ¾-in. pipe, a stuffingbox taken from a 2-in. gate valve with a ¾-in. thread is screwed into this hole. I tapped the bottom of box for ½-in. pipe and put in a brass plug, through the center of which a hole was drilled for the rod to pass through. The plug prevents the packing from going through into cylinder. The follower is made from a piece of old brass.



LUBRICATOR FOR AIR PUMP AND DETAIL OF STUFFING BOX

The rod goes into the cylinder 5 in. and is a piece of ½-in. steel. The piston rising strikes the bottom of the rod, pushes it up and when the piston goes down a spring pulls the rod down. A collar is set on the rod with a set screw which stops the rod from going too low. The spring is fastened to the oil pump rod at the top and to the washer under gland. The set screw on the oil pump was removed and the attachment slides up and down on oil pump rod instead of being stationary. The stand for the oil pump is made of ⅛-in. iron with a hole as a guide for rod, and 2 holes for studs on the main valve cap. We had to fill the old style lubricator every 24 hr., as it held only ½ pint. The pump we now have holds 1 pint and will run 8 days, as the pump gets oil only when working.

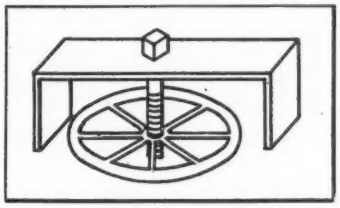
Earl Watkins.

PUMP TROUBLES

ONE of our small elevator pumps seemed to have more work when it was put in service than either of the others. When a car started, lowering the pressure, the pump would immediately refill the tank and stop with a constant hissing sound while it was stopped. The water pistons had been newly packed and as the pump would start frequently and run only 3 or 4 strokes I became suspicious of leaky valves.

The valves were all good except some were worn. Putting new valves in place of those that were worn and turning over the others did not better conditions. Finally after carefully examining the seats I found the grids were badly grooved in some cases, and being thick enough to turn could be faced up, but no tools could be obtained for such purpose which could be used in either the suction or discharge chamber, so the grid seats had to be removed.

I took a piece of ⅜-in. by 2-in. iron, bent it as shown in the illustration, the fork being just wide enough to span the grid seats, bored a hole in the center ¾-in. in diameter, and filed the ends square and of equal depth. I took a short bolt, passed it through the hole in the center and after removing the valve, spring and stud bolt, the yoke was placed over the grid seat and the bolt screwed down through the center of the grid seat, where the stud bolt had been removed and thus drew up the grid seat. This made an



JACK USED TO REMOVE PUMP VALVE SEATS

excellent jack for removing the valve seats, which were faced up at a local machine shop and replaced.

There was no more wheezing in the water end and the pump did not start until the cars started as the pressure held up well in the tank. The other pumps were repaired in the same manner, after which we noticed considerable saving in the coal used.

These pumps were too large to permit moving the tops of the discharge chambers which would necessitate disconnecting the discharge pipe, which would have been a very laborious job. In some pumps, however, the grid seats are screwed into the castings instead of being pressed in and then a different method must be used to draw them out.

R. A. Cultra.

PUMP DIFFICULTIES

I WOULD suggest to H. M., in regard to his pump difficulties, that the air chambers may not be large enough to properly cushion the valves and plungers. He is pumping against a very high pressure, quite out of the ordinary, and it is a question whether there is sufficient air in the chambers to take up the jar in case the cylinders do not fill with water on account of probably having a long lift. I would suggest placing a large suction chamber on the line near the pump which will assist in keeping the pump filled with water at all times. If properly applied this should prove a good remedy.

Again, the steam valves might have a little too much lead, which would cause the pistons to travel too far and strike the heads enough to cause a pound.

George G. Bennett.

MORE ABOUT STARTING THAT CORLISS ENGINE

ON page 369 of the May issue W. H. Wakeman tells us how to start a Corliss engine, but his answer is wrong and misleading. Such answers ought not to be given, because it is hard enough for some of us to learn correct answers to these questions, without

studying wrong ones. Probably he has never seen a Corliss engine. When such an engine is shut down and the valves unhooked you cannot get steam into the cylinder until you rock the wrist plate, and hook the valves on again. The original question is all right."

P. C. V.

Replying to the above, would say that there are many Corliss engines in use that never had a wrist plate on them as the valves are operated without it, therefore, if the steam valves of a Corliss engine are unhooked, and the engine cannot be started until a wrist plate is rocked, and there is no wrist plate on it, must it remain shut down? The original question does not mention a wrist plate.

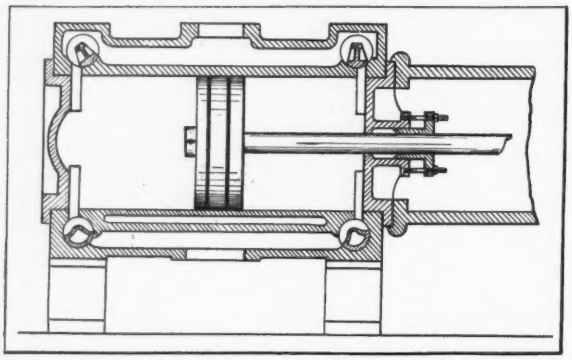


FIG. 1. POSITION OF VALVES WHEN ENGINE IS STOPPED

For the benefit of P. C. V., would say that I have operated Corliss engines for 7 yr. out of the 33 that I have served as operating and chief engineer. During this time I have carefully studied Corliss valves and gears, also made many experiments with these machines. I have also served on the examining committee of a branch of the N. A. S. E. for about 20 yr. My experience here has taught me that as a general rule engi-

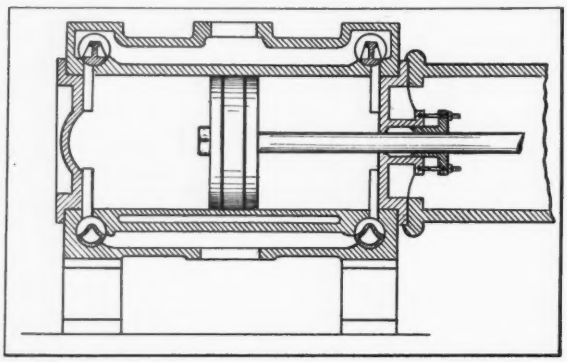


FIG. 2. VALVE POSITION WITH WRIST PLATE AT CENTER OF TRAVEL

neers fail to grasp the meaning of a question, until they have had a considerable practice along this line. This is not a theory but a condition.

The only mistake in my letter in the May issue is that it is too brief, hence fails to fully explain my meaning to those who are not well posted. A remedy for this defect is now offered.

The original question follows, because readers may not have it at hand: "A Corliss engine that cuts off at ¼ stroke, is stopped with the piston at the middle point of its travel, and consequently with both steam valves closed. How would you start it? " This question is incorrect, confusing and illogical. It is incorrect because it states that when a Corliss engine is shut down with the piston at ½ stroke both steam valves are closed. Assume that this engine is fitted with a wrist plate, and a stop motion. Let us follow the process of shutting it down. First, block the governor to prevent the stop motion from operating. Second, shut the throttle valve, and the engine will stop. If the throttle valve is handled properly the piston can be brought to ½ stroke without touching anything else. The valves and piston will then be in the position shown in Fig. 1. The only thing necessary to start the engine is to open the throttle valve and it will go.

The question is confusing because it states that when the engine is running it cuts off at ¼ stroke. This has no bearing whatever on the case mentioned. It was evidently intended to give the applicant the idea that if cutoff took place at ¼ stroke, and the piston was at ½ stroke, no more steam could be admitted to the cylinder. If not thoroughly familiar with the operation it certainly would confuse him.

The question is illogical because it calls for the explanation of things that are not properly a part of the shutting down and starting up process. For illustration, if an engineer is afraid that his Corliss engine will stop on a center, he can unhook the wrist plate and operate the valves by hand when the flywheel is running slowly. Having brought the piston to ½ stroke, the process is not complete until the wrist plate is hooked on again, which brings the valves into the position shown in Fig. 1. To start the engine, open the throttle valve.

Now, some engineers wish to add a flourish or two at this point which is perfectly proper. This may be done by unhooking the wrist plate and bringing it to the center of its travel. In this case the position of valves is shown in Fig. 2. As both steam valves are now closed, no steam could get into the cylinder, even if the throttle valve should be opened. It is necessary to hook up the wrist plate and restore conditions shown in Fig. 1.

Carrying it farther consists in bringing the wrist plate to the center of its travel, and unhooking both steam valves. This gives the valves the position shown in Fig. 2 except that the steam valves lap their ports more. It is now necessary to hook up the steam valves in order to start the engine. This may be done by rocking the wrist plate, but it is not the only way to do it. When the wrist plate is again hooked on, to start the engine proceed as follows: Open the throttle valve.

The operation of unhooking the wrist plate, or the steam valves is not a legitimate, or necessary part of the shutting down or starting up processes, any more than removing the flywheel would be. The habit of rocking the wrist plate back and forth when starting the engine, and slamming the hook on when a considerable speed has been secured, is not proper, hence should be abolished.

W. H. Wakeman.

OIL IN BOILERS

IN reply to J. J. Lee about oil in boilers, I would say, I have handled both steam shovels and locomotive boilers in North and South Dakota, and I couldn't keep enough water in the boilers to form any scale. Mr. Lee does not say what kind of oil he uses in his boilers, I will give my experience with oil.

The plant I am now handling, when I took it over 2 yr. ago, was using a great deal of condensed water, the exhaust from the engines went into a closed tank

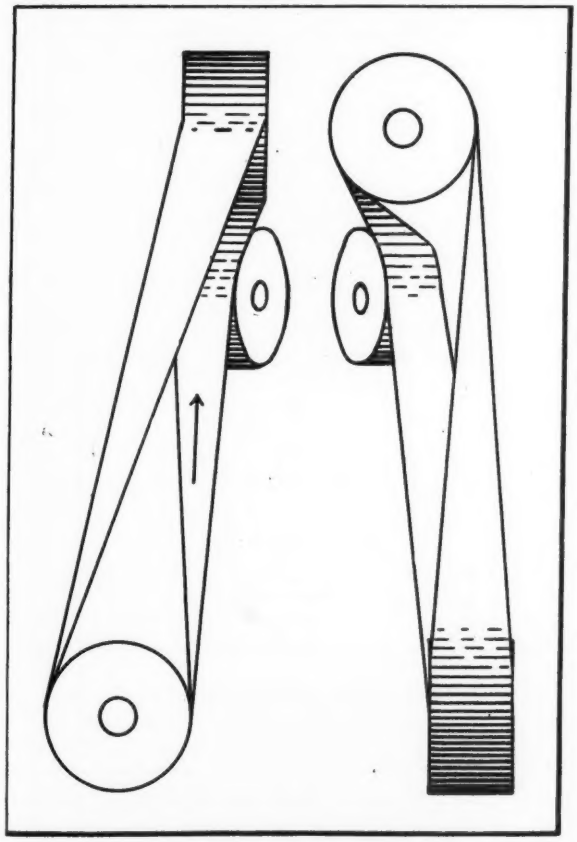
and the water went from there into the hot well and was pumped into the boilers. We had no oil separator and the lubricating oil went into the boilers with the water. We had trouble with the flues leaking, they had to be rolled on an average of about every three weeks; even in the steam lines the oil worked through every joint but showed no steam leak.

Our hot well is changed now and hardly any oil gets into the boilers, and we have very little trouble with our flues. I have 2 boilers and the flues haven't been touched in about 8 months. The scale formed in the boilers when oil was in the water was so hard it could hardly be touched with a scaling hammer, but now is very soft.

N. R. Ewing.

QUARTER TURN BELT

I HAVE had the same trouble as H. A. C. with a quarter turn belt and am sending a rough sketch showing my solution. I run the idler on the tight side of the belt close up to the drive. I used the same size pulley for the idler as the drive and set the face of



QUARTER TURN BELT WITH IDLER

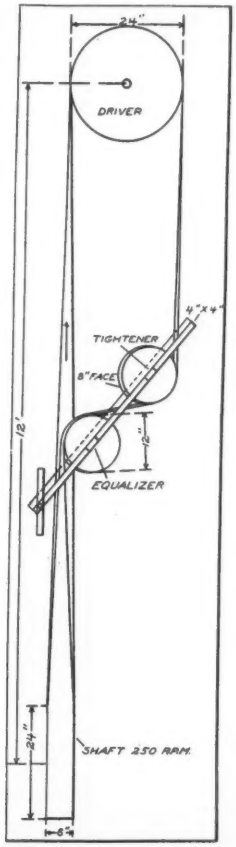
the idler even with the edge of the driven pulley, and had no more trouble.

Run the idler as close to the drive pulley as possible, also as far under as the belt will allow, have the idler the same size as the drive pulley and place the centers in line with the idler at an angle to suit, about 45 deg. J. A. McG.

IN reference to the trouble experienced by H. A. C. with the quarter turn belt mentioned in a recent issue I would say that it is absolutely impossible to get the requisite power from a 6-in. belt at 4 ft. centers of shafts, especially when the driving is from a 7-in. diameter pulley to a 12-in., the shafts should be not less than 8 ft. between centers for a 6-in. belt.

Even then the driving and driven pulleys should, if possible, be increased to, say, 12 and 17 in. in diameter in order to avoid an excessively tight belt and slippage on the smaller pulley. If this cannot be done, use larger pulleys on the 4-ft. center shafts, these pulleys should be at least 7-in. face for a 6-in. belt, or better still, providing there is space, have 2 7-in. and 2 12-in. pulleys 4-in. face for 2 3-in. belts, because the 2 3-in. belts will give better contact under the same conditions than 1 6-in. belt, thus avoiding slippage and consequent burning of the belt. Use the best quality of single leather belting, either endless or wire lacing, so as to have the belt run as smooth as possible over the driving pulley, also see that the belt is fairly pliable in order to insure good contact. W. S. L.

I NOTICE in the Transmission number several diagrams of quarter turn belts illustrated, and not seeing any there such as I use I send a sketch of it, and hope



QUARTER TURN BELT AND TIGHTENER ARRANGEMENT

it will be the means of helping some brother engineer.

This quarter turn arrangement has run for 12 months and the belt has been taken up just once, that is every minute of time that has been put on it since it was installed except for oiling. I use a 6-in. single, endless leather belt, shaft runs at 250 r.p.m., the frame for tightener and equalizer is made of 4 by 4 in. pine and if not heavy enough it can easily be weighted.

This is the finest running arrangement that I have ever seen. No engineer can appreciate it until he

sees it running, as my habit of saying is, it runs like a clock. Wm. F. Kunkel.

WE have a quarter turn belt in our plant, but it never causes any trouble. My remedy for H. A. C.'s trouble is to run the belt quite loose and use some good belt dressing. I think that will help him out.

P. L. Hatch.

ENGINE OR TURBINE

REGARDING the new installation of J. M. S., under the circumstances, I think he would be on the safe side by choosing a cross compound condensing Corliss. He expresses a doubt of being able to hold a high vacuum in summer and this and superheated steam are the very things on which a turbine depends for efficiency, as a drop in vacuum will affect a turbine much more than a reciprocating engine.

The record efficiency of the turbine so far obtained, was under the most favorable conditions, and I think, showed 13.5 lb. per kw. hr. (Westinghouse Parsons, 500 kw.) with saturated steam. 28.5 vacuum. A Corliss compound with 25-26 in vacuum would probably, in the same first-class condition, use about 14.5 to 15.5 lb. per kw. hr. With injection water at 70 deg. F., this would require about 30 lb. per pound of steam. A low-pressure turbine requires that as high a vacuum as possible be maintained. Wm. Chaddick.

ROD LUBRICATION

SOME years ago, when I took charge of a plant containing an engine that had metallic piston rod packing rings, and which took quite a bit of oil to keep the packing from leaking, I rigged up a swab and also a swab holder, which saved quite a bit of oil, and kept the rod well oiled all around. I took a piece of sheet copper and cut a hole in it just large enough to clear the rod and bent it as shown in Fig. 1, and cut it through on one side so that it could be slipped over rod, as in Fig. 2.

I took some candle wicking and braided it so that it fit around the rod good and tight, then I tapped the

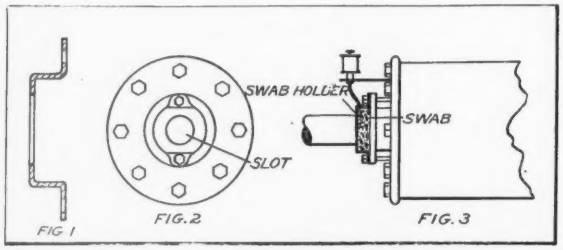


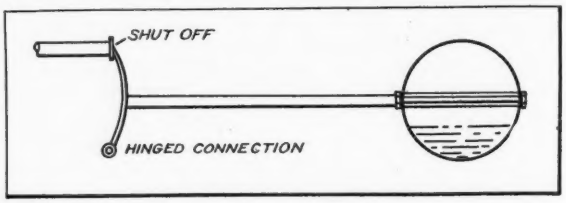
FIG. 1. SIDE VIEW OF SWAB HOLDER
FIG. 2. SWAB HOLDER IN POSITION
FIG. 3. LOCATION OF OIL CUP

cup and connected a small pipe so that it allows the oil to drop onto the swab, through a small hole on top of the swab holder, as in Fig 3. Before I put on the swab it took 4 cups of oil for a 10-hr. run, after putting on the swab one cup of oil would last over 10 hr.

Fred Langbein.

FLOAT FILLED WITH WATER

MUCH of the waste around an engine room is due to a mechanic using the old cut and try plan of fixing things. I had some trouble with a feed-water heater last summer, which emphasized the fact. Too much water came through the opening, which the float regulated, and there was apparently no way of remedying the defect. The mechanic remarked that he had put on a new gasket there only the month before and that he intended to go over every connection again now and tighten all the valves and put a new gasket at every joint. He said the float worked all right, but it did not close the opening entirely.



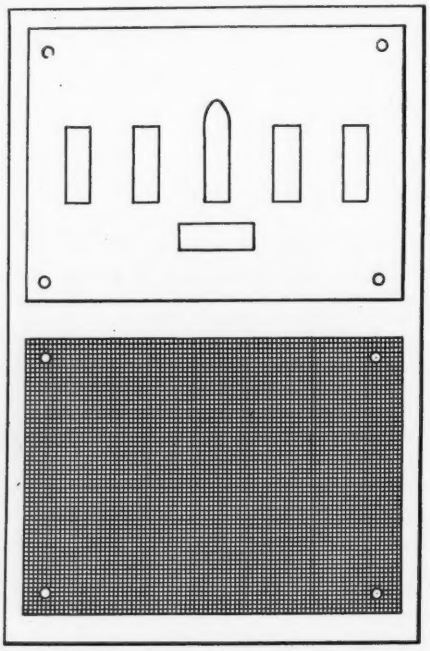
FLOAT CONTAINING WATER

He had already spent a couple of hours taking the heater apart, when I appeared on the scene. One look at the parts convinced me they were in perfect working order, and I decided the float was at fault. It might have accumulated a heavy covering of sediment. It was perfectly clean on the outside, so I shook it and found there was quite a bit of water inside. It took only a few minutes to get the float off the rod upon which it was suspended and cost 15 cents to have a tinsmith apply a drop of solder to the opening made in getting the water out.

C. L. Herrick.

SCREEN WIRE GASKETS

SOME time ago there was sent to the plant where I am employed a sheet of rubber gasket material which was 1-16 in. thick and the maker omitted to place an identifying stamp on it. It did not look good



SCREEN WIRE REINFORCING AND GASKET OF POOR MATERIAL

and I found that I could easily tear it into small bits with my fingers, so I had my doubts about what it would do in a bad joint under 160 lb. steam pressure, but I soon had an opportunity to learn.

A gasket blew out between the steam chest and

cylinder of a 6 by 36-in. deep well pump and I put in one of the new material, in fact I put in several, so many that I began doing the job in my sleep. I have 2 of those 6 by 36-in. deep well pumps and 1 must be kept going at all times. The gasket blew out on No. 2 pump, so between shifting pumps and placing gaskets I could do nothing else until finally the trouble was stopped in the following manner:

I cut a new gasket and on each side of it put a piece of common door screen, making holes for the cap screw only and made the joint up tight. The fine mesh kept the rubber from creeping and it held perfectly, but when I got the new gasket material I took it out; it was still in good condition and I am keeping it for future reference. B. F. Hartley.

EDUCATION VS. ABILITY

WHILE the writer is a firm believer in education, yet he has always held that a man must have some talent for the business he follows. That this holds good in the case of engineers has been forcibly brought to mind by the general character of 2 plants which I visit regularly.

The first one we will take up is a large mill in a central western manufacturing center. Its total rated capacity is nearly 10,000 hp. All the machinery is up to date, or as nearly so as money and operating conditions can make it, backed by a liberal and progressive management with ample capital. This plant has water-tube boilers, stokers, direct-connected generators, with compound condensing engines; costly and elaborate facilities for fuel and gas testing, with feed water treatment.

The chief engineer, while a well educated man, is totally devoid of mechanical ability. While he can figure the most abstruse problem he has no knack of applying his knowledge effectively. His boilers are unusually dirty taking into consideration the amount of money spent to provide equipment to keep them clean; his furnaces are always in such condition that from 1 to 3 boilers are down for furnace repairs. On a visit recently 4 were off on account of furnace faults and another with leaky tubes. The settlement near the works gets most of its fuel from the cinder dump along the river bank. The night crew, so I was informed by one of them (who considered it quite a joke), makes a practice of doctoring the flue-gas analysis by drawing all the gas from one furnace when in good condition for a high percentage of CO_2.

The main engines carry a very light load with boiler pressure about 160 lb. gage; while in one mill the driving engines are badly overloaded, yet the steam is reduced to 120 lb.

Discipline is on a par with the mechanical practice. Drunkenness is not an unknown quantity in the department. Few take the pains to ask for a leave of absence; they simply lay off when they don't wish to work. Sleeping while on duty is the rule rather than the exception; and the third class engineer gets the same wages as a first class man. The percentage of third class men outnumbers the first by 60 per cent actual count.

That fuel bills are enormous for the power developed goes without saying; stops are frequent; twice have I seen the entire plant down for things which any skilled engineer would have handled easily without a stop or more likely avoided altogether.

I met talent versus education in the wilds of Western South Dakota, 35 miles from a railroad and almost 100 to the nearest machine shop. This is a small plant consisting of one ordinary tubular boiler 60 in. by 16 ft., a small Corliss engine, one feed pump, no injector, and an old time closed heater. A plant which looks anything but inviting. The engineer is a man past middle age who can scarcely write his name.

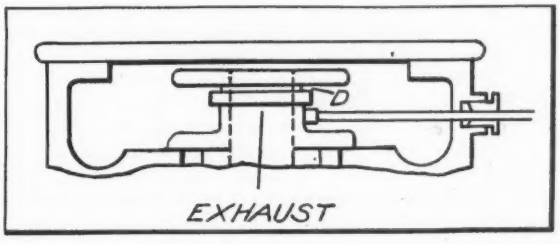
On a close inspection there are several things about this old time plant to attract attention. Here we find a feed water carrying 427 grains of impurities to the U. S. standard gallon. Yet the boiler is practically free from scale; the engine and pump shine like a new pin and run as nearly noiseless as possible.

You might sift a wagon load of the cinder pile and not get a pint of coal or coke. The feed water enters the boiler at a temperature of 208 deg. F. The only shut down the manager remembered has been so long ago that the cause has been forgotten. One look over the plant would satisfy the most skeptical that it was being operated at the lowest possible expense.

As stated in the beginning, the writer is a strong believer in education; without it the first man would have to seek a livelihood at some other calling. With it the second man might have risen to the highest position of the calling. I often wonder what would happen if these engineers could be transferred to each other's position, which would be the more surprised and helpless. I leave it to the reader's imagination. Traveler.

BALANCED VALVE TROUBLE

SOMETIMES the best of valves will give us trouble. The accompanying sketch shows how a balanced slide valve gave trouble. The fireman, who was a colored man, said to the engineer, "Say boss, somet'in' sure am wrong wit dis engine." Now, strange to say this craft will detect a slight change in the working of a plant and especially so if it reduces or increases the work necessary on their part. So the engineer went out and looked at his exhaust pipe and sure enough he found that there was something wrong with the engine, so he shut down and opened the steam chest only to find the balance ring of his valve

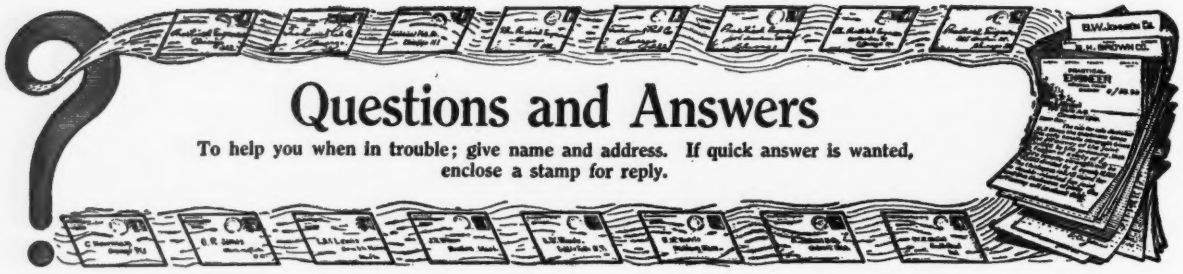


BALANCED VALVE WITH RING STUCK

stuck as shown in the drawing. The ring D was stuck down, and the live steam was passing right out over the valve to the exhaust opening.

I have had these balance rings to stick, which is usually caused by a change of water in the cylinder and this generally lifts the valve at the end that the water is caught in, and cants the valve and sticks the ring so that the small spring will not throw it back to its place. I have brought the balance ring back sometimes by striking the valve chest cover with a block of wood. The rings seldom stick but in some cases they will just as did the one cited.

C. R. McGahey.



Questions and Answers

To help you when in trouble; give name and address. If quick answer is wanted, enclose a stamp for reply.

THE CHIEF ENGINEER'S CATECHISM III

COMPARE the evaporative qualities of coking and noncoking coals and explain the differences in the methods of firing.

2. Is anthracite best adapted to hand or stoker firing, and why?

3. Can oil compete with bituminous coal as a fuel for a boiler furnace, and what is your reason for your answer?

4. Regardless of first cost, which type of boiler do you prefer?

5. Should steam jets ever be used in a furnace, and why not?

6. Do barometic conditions or altitude above sea level affect stack draft?

7. Can boiler feed water be satisfactorily purified by cold water treatment?

8. What types of feed-water heaters are in common use and explain the advantages of each.

9. How high above the suction opening of a pump should the outlet from the heater be placed?

10. What kind of valves would you use on feed water piping, and why?

(The best set of answers to these questions will be paid for at the regular rate and the author of the second best set will receive a prize of $3. Answers will be published in the September issue and all answers should reach Practical Engineer not later than August 1.—Editor.

HEIGHT OF STACK

WE have a brick stack that we would like to raise, it is 45 ft. high and as we are going to increase the horsepower from 80 to 150 hp., how much higher will we have to build it to get good results? F. L.

A. According to the best data available, your stack should be 60 ft. in height in order to take care of 150 hp. This depends, of course, upon the amount of coal per horsepower hour that you are burning, also upon the character of the coal, as it takes a much stronger draft to burn a fine run of mine than it does to burn a coarse lump coal.

The horsepower varies as the square root of the height, so that if your 45-ft. chimney just takes care nicely of the 80 hp. you should divide the square root of 45 by 80 and multiply it by 150. The result will be the square root of the new height, and if you square that figure you will get what the new height should be. This would give 145 ft., as the new height of the chimney, which does not seem correct. Your chimney, 38 in. square by 45 ft. high, ought to be able to take care of about 150 hp. as it stands.

ENTHUSIASM IS JUST plain Brain juice, squeezed out and reduced to its highest action power. And the harder the squeezing the greater the enthusiasm. Squeeze.—System.

ANSWERS TO THE CHIEF ENGINEER'S CATECHISM—I

QUESTIONS IN THE MAY ISSUE

By William E. Dixon

B. T. U. is the abbreviaion of British thermal unit. This unit is that quantity of heat required to raise the temperature of 1 lb. of water 1 deg. F. when the water is at or near 39 deg., at which temperature water is at its maximum density.

2.—Everyone knows that there is a wide difference in the burning and heating qualities of various coals. The writer once tested 5 different grades of coal in a manufacturing plant, burning each grade for 2 weeks. The coal at highest price per ton proved to be the cheapest for us to buy; that is, it gave us the most work per dollar spent. The cheapest priced coal would have been the most expensive for us to buy. In fact, taking the 5 grades, the efficiency of a dollar's worth increased with the price per ton.

In another plant in the same town a similar test gave very different results. This indicates that we need some way of determining what coal is most economical for us to buy. And once this is settled there arises another problem: How shall we be sure we continue to get what we pay for? It will not do to follow the plan of some buyers, to judge the coal by its looks. This is a very simple plan, but that's all. Others buy coal with a certain name hitched to it; but most of us have learned that there is not much in a name. Other companies test each new lot in the furnace; while many buy upon the B. t. u. basis. What is the method?

Coal is made up mainly of fixed carbon and volatile hydrocarbons (hydrogen and carbon in combination) and noncombustible minerals which we group as ash. Now we know that the complete combustion of 1 lb. of carbon will produce about 14,000 B. t. u. and combustion of 1 lb. of hydrogen will give about 62,000 B. t. u. Then if the chemist tells us the percentage of hydrogen, carbon, etc. in a sample of coal, we can easily compute the number of B. t. u. in a pound of that coal. Here we have a means of setting a standard for the coal dealer. It is heat that we want and we can hold the dealer to a contract that each ton he brings us must show a certain number of heat units, B. t. u.

If he happens to bring us coal richer in heat, containing more B. t. u., we will pay him a premium; but if his coal falls below the standard, he must forfeit for every B. t. u. below the stipulated number.

This seems a scientific solution of the problem, and yet there are difficulties about it that render it far from perfect. To get a sample of a few ounces which shall fairly represent the contents of a car seems almost a matter of chance. A shovelful is taken from

various parts of the car. These are mixed and crushed and mixed and part of the pile discarded, and then more mixing, etc., till we get down to a tiny sample.

Even when the greatest care is taken in the operation, it seems unreasonable to expect that the sample shall have the same percentages as the entire shipment. This is one objection, that the sample is not surely representative.

Again, of 2 coals having exactly the same number of B. t. u. per ton, one might sift through into the ash much more than the other. Chemical analysis cannot show us anything about this.

In the third place, the conditions in our plant may be such that a coal high in fixed carbon, but low in volatile, will give best results. The dealer may send us a coal high in volatile that will analyze so as to show more B. t. u. than the standard, and we pay a premium for a coal that actually won't do our work as well; from which we shall be unable to utilize as much heat and for which we pay more money. The chemist's methods of determining moisture and ash have also been called in question, and it is probably true that the man in the fire-room can secure more accurate results.

These are some of the drawbacks to the B. t. u. basis for buying coal. But because the method is not perfect, does not necessarily mean that it is to be thrown aside. If we should begin throwing aside imperfect machines and devices we would have a pretty big junk heap before we got through. We wisely continue to use the imperfect things, keeping the imperfections in mind, however, and striving to improve them. If we keep in mind the limitations of the B. t. u. method, we may use it to very good advantage. Probably the best plan is to combine it with an evaporation test in the furnace.

3.—Anthracite having been subjected to more pressure and more intense heat, the volatile matter has been largely distilled and the coal is therefore high in fixed carbon. It is hard and difficult to ignite, and burns with short flame.

Bituminous coal has retained a large part of the volatile matter. It therefore kindles easily and burns with a long flame, and, unless much care is exercised, with much smoke. It crumbles easily.

4.—Low grade coals make more smoke. In the first place they contain more volatile matter. In the second, they contain more ash and this makes it more difficult to supply air in the manner suitable for best combustion.

5.—Heating surface per rated horsepower for different types of boilers is as follows: Water tube, 10 sq. ft.; return tubular, 10-12; vertical tubular, 10-12; locomotive type for stationary use, 10-12; plain cylinder, 6-10.

Formerly it was considered good practice to allow the higher figures—12 sq. ft. per horse power in tubular boilers. Recent investigations have shown, however, that these boilers do better work when more coal is burned per sq. ft. of grate per hour. For this reason the lower figures are better practice today.

6.—As a general proposition we should try to introduce feed water away from the hottest portions and at the same time where it will enter at once into circulation. Makers of water-tube boilers have generally done these 2 things very carefully. For instance, in the Stirling the feed enters the rear drum farthest from the fire and is forced to circulate downward through the rear bank of tubes. In the B. & W. the feed enters at once into strong circulation.

In the return tubular boiler the place best filling these conditions is over the tubes at about 1-3 the length of the boiler from the rear head, away from the hottest part of the shell over the furnace and away from the hottest part of the tubes, which is at the rear. In a vertical tubular boiler, feed should be discharged among the tubes a considerable distance above the crown sheet.

7.—In burning coke or small sizes of anthracite special methods must be adopted. The best method of burning soft coal, hand fired, seems to be to have some part of the fuel bed at all times well coked, so that the gases distilled from freshly fired coal shall be burned in passing. One way of doing this is to fire the coal in a heap just inside the fire door, and after it has "coked" to spread it out with a heavy hoe and add a fresh firing. A better way, it seems to me, is the alternate method, firing of one side the furnace at a time. The heat from the bright side aids in burning the gases from the freshly fired coal and more air is being passed through the bright side than would be if it, too, had just been spread over with green coal. This air reaches the furnace just when needed for combustion; also it is hotter coming through the bright side than it would be if it had to pass through freshly fired coal.

8.—The same furnace will not answer for all coals. A coal high in volatile will need more space for combustion. The rate at which various coals will burn economically varies, so the grate area for one coal might not be suitable for another. Some coals need more air than others and a grate suitable for one might not be best for the other.

9.—Draft needed varies with the fuel to be burned. Hutton gives the following as minimum draft for satisfactory combustion of various fuels. Straw, 0.2 in.; wood, 0.3.; sawdust, 0.35 in.; peat, 0.4 to 0.5 in.; steam coal, 0.4 to 0.7 in.; ordinary slack, 0.6 to 0.9 in.; very small slack, 0.7 to 1.1 in.; coal dust, 0.8 to 1.1 in.; semi-anthracite, 0.9 to 1.2 in.; anthracite (round), 1.2 to 1.4 in.; anthracite slack, 1.3 to 1.8 in.

10.—High and short as applied to chimneys are relative terms. In general it may be said that where conditions would call for one stack over 150 ft. high, it will be better and cheaper to build 2 shorter stacks. The cost of chimney above this height increases rapidly as we go up. On the other hand, unless a fan is to be used, we must guard against getting a stack too short; for the shorter the stack (other things being equal) the hotter we must heat our chimney gases to produce the required draft. First cost is not the only thing to be considered. A few degrees continually added to the temperature of the flue gases may soon cost more than the more expensive installation. Except in small installations, however, a short stack with a fan will probably prove more economical.

BY WM. CHADDICK

1.—The B. t. u. is the amount of heat necessary to raise 1 lb. of water from 62 deg. F. through 1 deg., and as heat which is molecular energy may be converted into mechanical energy, this heat unit which was determined after repeated experiments by Joule in Manchester and others after him to be equal to 778 foot-pounds.

3.—Bituminous coal is the kind from which all coals are supposed to have been formed by a process of natural distillation combined with pressure, and all are produced by the decay under water of the conifer, fern and palm families, which grew in great profusion during the carboniferous period, which must

have lasted a very long time, as it has been calculated that the accumulation would be about ⅛ in. per century, or 1 ft. in 10,000 years.

Anthracite is probably the oldest formation which through pressure and distillation has lost much volatile gases and gained carbon; the composition is approximately: Water, 2 per cent; volatile matter, 4.3; carbon, 86.5; ash, 7.2 per cent. That of bituminous being: Water, 9; volatile matter, 27.4; carbon, 64.0; ash 77 per cent.

4.—As a rule the higher grades of bituminous coals will be more smoky if not properly fired, on account of the quick distillation of volatile gases, which, if not supplied with the proper amount of air, will pass off together with unfixed carbon unconsumed, while in the lower grades of coal for equal weight there will be less smoke liberated quickly on account of the higher percentage of foreign matter. But the more frequent use of the slice bar and more frequent cleaning on the lower grades will for a time stir up dense smoke.

Personally I would prefer the higher grades.

5.—Cornish or Lancashire boilers have a ratio of heating to grate surface of 20 to 1, and about 7 sq. ft. of heating surface per boiler horsepower; return tubular, 12 sq. ft.; water-tube boilers from 9 to 12 sq. ft., and Scotch marine, about 3.5 sq. ft. per horsepower.

6.—It has been recommended to carry a feed pipe through the front head, continuing back lengthwise of the boiler a few inches above the top row of tubes to within a couple of feet of the back head, and then, having perforated the pipe through the latter half sufficiently to discharge the feed, cap the end. The objection that I see to this is the perforations may fill with scale.

Instead of a cap, run the pipe across the boiler to the middle row of tubes and discharge downward through an elbow. If there is a good heater I much prefer feeding through the blowoff, having never noticed any ill effects of this method in 14 years, while it has the advantage of keeping up circulation in the blowoff, which I think very important.

7.—I have heard some engineers advocate the coking method. In theory it looks good, but practically it has some disadvantages; for instance, a very hot fire must be kept on the active portion of the grate, and as naturally most all clinker will form here, it is a difficult matter. Suppose that 2-3 of the grate is active while 1-3 is coking coal. Sufficient must be coked here to keep the 2-3 well covered in order to give sufficient heat to hold steam; in fact, with heavily loaded boilers I hardly think this possible.

If a good, bright fire from 6 to 10 in., according to draft and kind of coal is carried, firing being done at short intervals and fuel scattered evenly and lightly over one side at a time and a proper amount of air admitted, I think as good if not better results will be obtained. Another important point is not to overwork the fireman; give him time to think.

In regard to firing of coal, C. B. Hudson writes, after mentioning the alternate and spread firing methods: "The writer prefers to fire both doors at a time, charging the front of the grate only, allowing the coal to coke, after which it is sliced and pushed back ready for a fresh charge in front. This maintains a hot bed of coke near the bridge wall, over which the fresh gas discharged from the front must pass, being consumed in so doing.

"This is a very efficient method but requires close attention. Allowing a small amount of air to enter through the fire doors after each charge of fresh fuel will aid materially in producing smokeless combustion."

Speaking of the buying of coal, John Melville says: "While the determination of the B. t. u. value is important, it does not always follow that the coal showing high heating value by analysis or calorimeter will give best results. The percentage of ash in any coal is a pretty sure guide as to quality. The less ash the better the coal, consequently I would prefer to buy coal on known actual results rather than on the chemists' reports."

Fred G. Haney, discussing the method of delivering feed water, says: "The feed water should enter a boiler through the front end as this is handy for the fireman to close the valve in the delivery pipe if necessary. The pipe should be at the lowest available point and empty into the boiler and should empty straight, as this keeps the boiler from discharging into the steam space and permits the cold water to rise as it becomes heated. The pipe should extend several feet into the boiler if possible, thus heating the feed water before its actual discharge into the boiler. This arrangement also carries the sediment contained in the water away from the front end of the boiler toward the mud drum."

H. C. Combs, speaking of the buying of coal, says: "If a plant is equipped with necessary testing apparatus it is best to buy coal on a B. t. u. basis. Testing a boiler plant frequently or continously will give the actual performance of the plant and variations, but will not show the why of variations. To find out what changes give improvements in operation requires the use of instruments which can be applied at different points in the furnace to give indications of furnace conditions, and without these it would make no difference whether you bought coal on a B. t. u. basis or not, but with proper instruments you can tell if the coal contained the B. t. u. the contract called for and with proper testing also the efficiency of the boiler and whether coal was being burned properly or not."

Speaking of methods of firing Mr. Combs says: "Every fireman, if observant, should be able to judge as to the best method of treating the coal he is using. A few general maxims may be laid down: First, keep a clean fire; second, see that every square inch of grate surface is covered with good live fire; third, keep a good live fire without hills and valleys and yawning chasms; fourth, always be sure to clean all the clinkers and dead ashes away from the back end of the grate at the bridge wall, giving the air a free passage through the bars, as this air is permitted to come in contact with the hot fire brick of the wall and is one of the greatest aids to good combustion."

Angle of Belt Pull

HOW can I determine where the pull comes on bearings when using belt drive with the pull on the bottom side. We have 2 pulleys located as follows: The center of the driver is 3½ in. above the floor line and 55 in. in diameter. The driven is 2 ft. 7 in. above the floor line and 20 in. in diameter. From center to center of the 2 pulleys is 22 ft. 1½ in. Where would the pull come on the bearings?

2. A claims that a square yard has nothing to do with depth. B says that a square yard is 3 ft. long, 3 ft. wide and 3 ft. deep. B claims that it is 3 ft. long, 3 ft. wide and 1 ft. deep. Which is correct?

3. A claims, in excavation work, that 1 yard means 3 ft. long, 3 ft. wide and 3 ft. deep. B claims that it is 3 ft. long, 3 ft. wide and 1 ft. deep. Which is right. W. I. N.

A. A sketch drawn to scale showing the arrangement of your pulleys is the best way to determine the angle of belt pull. This shows 6 deg. as the angle between the horizontal and the line of centers of the pulleys. It will depend whether the pull is on the bottom or top of the belt just where the pressure will come on the bearing.

If the bottom side of the belt is the tight side it will tend to make both of the pulleys climb up toward the right, while if the top is the tight side it will tend to make both of the pulleys climb a little toward the left side of the bearing. This climbing will, however, not be very great and you would be safe for all practical purposes in considering the belt pull as coming on a line at 6 degrees to the horizontal.

2. A square yard has nothing to do with depth. It is simply a surface measurement.

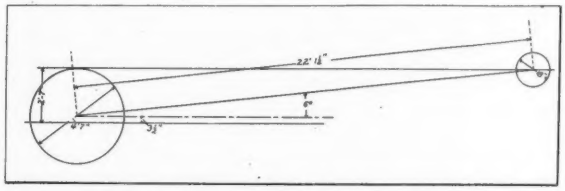


DIAGRAM FOR FINDING ANGLE BELT PULL

3. In excavations the unit used is always the cubic yard, 3 ft. long, 3 ft. wide and 3 ft. deep. An excavation 3 ft. long, 3 ft. wide and 1 ft. deep would have only 1/3 of a cubic yard.

Caring for Expansion

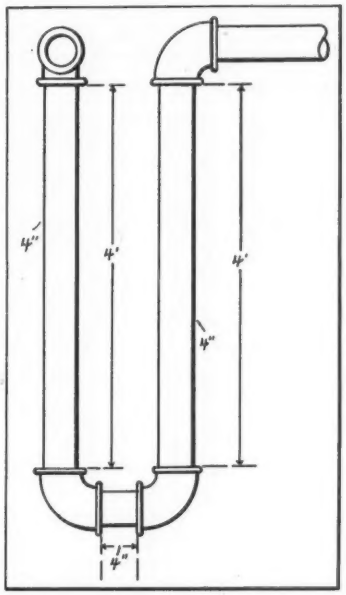
THE other day we had occasion to turn steam on a new line 100 ft. long, when we found there had been no allowance made for expansion, so we made what is known as a swing joint as shown in the sketch, to take care of the expansion. While we were putting the steam on gradually, the fireman asked me how much it would expand and I told him according to the formula it should expand 0.00000686 ft. per foot of length multiplied by the difference in temperature between the sensible heat in the building and the sensible heat of the steam.

The temperature of the building was 70 deg. and the pressure on the line was 100 lb. by gage, which equals 336.807 deg. Then 336.807—70=264.807 and 264.807×.00000686 ft. = 0.00181657602 per foot, this times 100 = 0.181657602 ft., multiplying this by 12 gives 2.18 in. linear expansion.

Now as the actual expansion was more than 2.18 in. the fireman asked me why the latent was not taken into consideration, he says, according to theory, 1 B. t. u. will change 1 lb. of water 1 deg. Now, if 1 B. t. u. will change 1 lb. of water 1 deg. up to 212 deg. and it takes 966 B. t. u. to change 1 lb. from 212 deg. water to 212 deg. steam, does or does not the latent heat give any linear expansion on the boiler or the steam lines? J. M.

A. The latent heat in the steam would have no effect on the expansion because the only thing that affects expansion of metals is rise in temperature, and the latent heat of steam does not raise the temperature, it simply goes into expanding the water into steam, temperature remaining constant.

The figure for coefficient of expansion which you have used is right for an average, but different qualities of wrought iron and different grades of steel vary widely as to this coefficient, which is probably the reason for the greater expansion in your pipe line than you have figured.



SWING JOINT TO CARE FOR EXPANSION

Meter Affected by Iron Conduit

IN the plant where I am employed, current for lighting purposes, which is 110 volts a. c., is purchased from the central station. One side of this circuit was run through an iron pipe conduit about 15 ft. long, but finding that this pipe got hot during a peak load, it was removed.

Shortly after, the meter was tested and found to be 20 per cent fast. The light company now claims that removing the pipe caused the meter to run too fast.

My question is, how could the iron pipe conduit effect the meter when the meter was connected between this conduit and the switchboard? E. O.

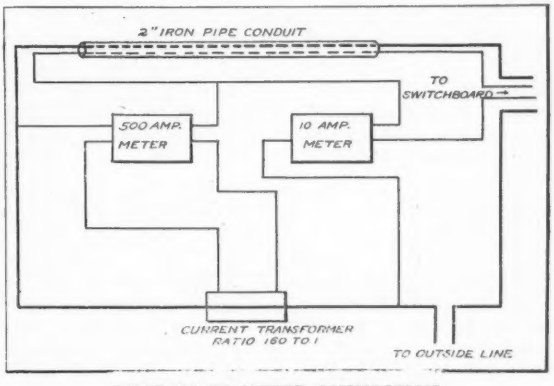


DIAGRAM OF METER CONNECTION

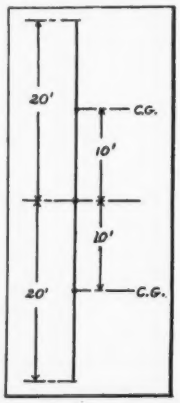
A. Passing the lines through an iron pipe conduit, as indicated, would cause a very considerable drop in voltage at this point in the line. From your diagram the voltage connection to the meter ran

through the iron pipe so that it would cut down the voltage on the meter. The meters were probably adjusted to be correct as installed with the pipe in place, and when this was taken out it threw a higher voltage on the meter, thus causing it to run fast.

Work to Raise Beam.

A UNIFORM beam weighs 1000 lb. and is 20 ft. long; it hangs by one end, around which it can turn freely; how many foot-pounds of work must be required to raise it from its lowest to its highest position? J. C. C.

A. The amount of work done, leaving out friction, which, I assume, is not to be considered, is the same as if the beam were lifted vertically through the distance necessary to swing it from the lowest to the highest position. In one case the center of gravity



BEAM IN ORIGINAL AND FINAL POSITIONS

is 10 ft. below the point of support, in the other case it is 10 ft. above the point of support, that is, the center of gravity of the beam has been lifted 20 ft. in swinging it from hanging vertically down to standing vertically above the support.

The work done would then be, the weight of the beam times this distance, or 1000×20, or 20,000 foot-pounds.

Cut-Off Position

AN Ingersoll-Rand cross-compound air compressor rated at 124 hp. with 100 lb. of air and 100 lb. of steam is operating with 90 lb. of air and 120 lb. of steam. The steam cylinders are equipped with the Meyer cut-off valves. The erecting engineer set the cut-off at ¾ stroke. Could not this be moved back to ¼ stroke and thereby secure greater economy of steam consumption? L. E.

A. The conditions under which the compressor is running would make a lot of difference as to how the steam valve should be set, but assuming that the friction is to be omitted, since there is no way of telling how much that will be with 100 lb. air pressure and 100 lb. steam pressure, the expansion ratio would be 115÷15, or 7.68 in both cylinders, which would give a steam cut-off at 0.13 of the stroke.

Of course, with friction taken into account, the steam cut-off would carry out much further than this. If, now, the air pressure be reduced to 90 lb., the ratio of compression will be 105÷15, or 7, and the mean pressure in the cylinder, neglecting clearance, would be 44.2 lb. The mean pressure in the steam cylinder, omitting friction, would have to be the same amount.

With steam at 120 lb. the ratio of expansion would be 135÷15 or 9, and the mean pressure ratio would be 44.2÷135 or 0.327, which corresponds, as indicated in the mean forward pressure table in the data sheet for the March issue, to one-tenth (0.1) cut-off.

In any case, it does not seem necessary or advisable to have the valve set for any such cut-off as ¾ stroke.

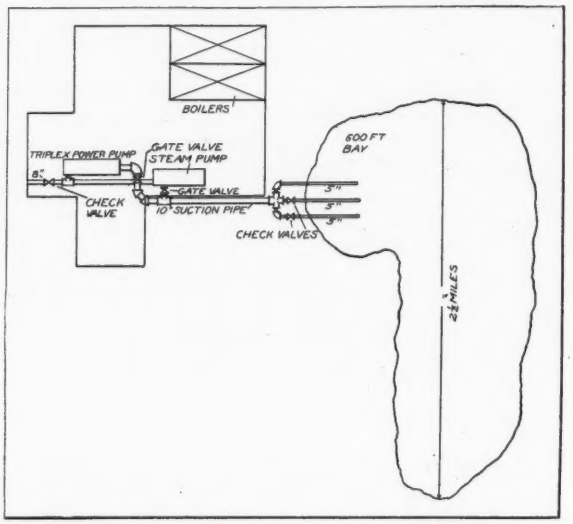
Pump Trouble

I AM sending you a sketch of a pumping plant that I am running here and I wish you would answer the following questions:

1. I notice when this lake is frozen over or real calm, that the pumps run smoother and seem to throw more water, and also when the wind blows from our end of the lake they seem to run better. Could there be the under tow in a lake as small as this when it is real rough, that creates nearly as much vacuum at the end of suction pipes as the pump does? That is the only reason I could give.

2. If that is the case what could be done to remedy it?

3. We are discharging through 14,800 ft. of 8-in. pipe and beyond that there are 3 smaller pipes for about 700 ft.,—one enters the bottom of the reservoir and 2 up a ways, and we carry 150 lb. pressure at the pumps. Our triplex pump runs 36 r. p. m. Could that pump



PUMPING PLANT LAYOUT AND LOCATION

hold the pressure any where near 150 lb., but still not deliver the full volume of water it should? The pressure has decreased in the last 3 yr. a little. Valves are in good shape and I have taken possible leaks into consideration. An opinion from engineers would be appreciated. E. T.

TO FIND THE PROPER weight of an engine flywheel, multiply the nominal horsepower by 2000 and divide the product by the square of the velocity of the circumference in feet per second, the quotient multiplied by 100 gives the required weight in pounds.

"IF WE KEEP BEFORE us the 10 most important things that we have to do, we shall avoid wasting time on frivolities."

WILLIS LAWRENCE

THE subject of this sketch is well known to many of the engineers in the Metropolitan district as well as throughout the country. Mr. Lawrence was born in Cold Springs, N. Y., June 30, 1868, and received his education in the district school at his native place. After leaving school he followed flower and vegetable gardening for 5 years but found such work uncongenial, as his natural bent was towards mechanics. Like many other men of mechanical inclinations who live in the country districts, young Lawrence found no promising field for his efforts near home, and so in order to make a start, he entered the employ of the Hudson River Stone Co., at Storm King, N. Y., in 1888. This company was then erecting a large stone crusher, and young Lawrence was first employed as a laborer, but subsequently passed through the grades of helper, oiler, machinist, and later had charge of all repairs. Eventually he was offered the position of assistant superintendent, but

he declined it and went to Weehawken, N. J., to assist in the erection of a new large stone crusher, assuming the position of engineer on its completion, and remaining there until February, 1894.

About that time Mr. Lawrence went with the New York Ice Co., which was then overhauling one of its refrigerating plants, located on 116th Street, New York City, and was assigned to assist in the overhauling. When this work was completed he was appointed assistant engineer, and was promoted to chief engineer in August of the same year. Here he remained until 1898, when he was transferred to the 18th Street plant of the same company, where he continued until January 2, 1902.

His next connection was with the Manhattan Elevated Railroad as engineer in the 74th Street power house, which was then building. From that time on his advancement has been continuous. In January, 1903, he was promoted to the position of first assistant mechanical engineer. On May 1, 1904, he was again promoted to chief mechanical engineer of the 74th street power house, and on May 1, 1907, he was made chief mechanical engineer of the Interborough Subway power house at 59th Street, in addition to the above, and has ever since been in charge of the power houses now under the Interborough Rapid Transit R. R. Co., of New York City.

Mr. Lawrence is the exemplification of a self-made man in the engineering field, and from the start of his association with his brother engineers in New York City he has been one of the leaders in thought and action toward the betterment of the engineering profession.

He has always been closely identified with the interests of the N. A. S. E. At first he was a member of No. 25, Manhattan Association N. A. S. E., and while enrolled as its member was successively elected delegate to the state convention in New York, vice president and president for three terms. He was also delegate to the national conventions held in Milwaukee, Rochester and Louisville. He was one of the prominent organizers of the General Committee of New York City and was chairman of that committee one term. He was also New York state deputy of N. A. S. E. for two terms. Mr. Lawrence has now affiliated himself with Felix Association No. 24, New York, N. A. S. E.

When the Institute of Operating Engineers was started, Mr. Lawrence became greatly interested in it and has held the position of chairman of the Vocational Statistics and Co-Operation Committee, and is a member of the executive committee of the National Headquarters. He has also recently been elected chairman of Branch No. 1, District No. 2, I. O. E.

UNIVERSITY OF WISCONSIN SUMMER ENGINEERING SCHOOL

ANNUAL session of the Summer School of Engineering, under direction of the College of Engineering of the University of Wisconsin, opens June 26, continuing for 6 weeks.

Regular and advanced courses are offered in Direct and Alternating Currents, Hydraulics, Machine Design, Descriptive Geometry, Applied Mechanics, Shopwork, Steam and Gas Engineering and Surveying. Elementary courses adapted to the requirement of those not having preparation for the advanced work are offered in Mechanical Drawing, Machine Design and Shopwork, in addition to which opportunity is offered for laboratory work in the Electrical, Steam and Gas Laboratories for those who have had power plant experience or correspondence instruction.

The teaching staff is taken from the regular instructional force, and all laboratory equipment of the Engineering College is available for students. For bulletin or further information address F. E. Turneaure, Dean, College of Engineering, Madison, Wis.

IN 1868 THE MANUFACTURE of Albany Grease was begun in Albany, N. Y., and in 1872 it sailed down the Hudson and established itself in New York City. The added requirements of the 43 yr. of growth have made necessary larger quarters, and the manufacturers, The Albany Lubricating Co., of which Adam Cook's Sons are proprietors, have recently moved into a new factory at 708-710 Washington St., New York City, where there will be increased facilities, making possible increasing promptness and efficiency of service.

A PROMISE SHOULD be made with caution and kept with care. It should be made with the heart and kept with the head.—William H. Baldwin.

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LOSS BY STORING COAL

It has been a tradition that storage of coal resulted in lost heating value, this belief being in part based upon the fact that coal loses its luster after standing exposed to the air and might, therefore, be supposed to undergo some chemical change. Tests of the heating value before and after storage have not seemed to bear out this idea, and some experiments recently reported by the Bureau of Mines give a clue as to the change which actually does take place. These experiments extended over a long period and were carefully made on samples enclosed in jars, in one case the gas being drawn off and in the other case oxygen being forced into the jars so as to watch the re-actions taking place. Different coals were found to vary greatly, both in the amount of gas given off and in the amount of oxygen absorbed, also in the rapidity of these 2 operations.

It was found that not only during the time of mining does coal give off gas rapidly, but also for a long time afterward, the rapidity at first and the slowing down afterward being shown by the accompanying diagram. This rate was taken beginning one hour after the mining, so that the giving off of gas does not include that thrown out when breaking down the coal, but is simply what is lost in the handling and storage of coal.

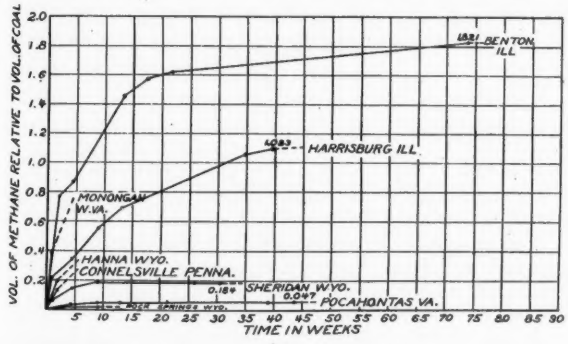
It will be noted that the Wyoming, Pennsylvania and Virginia coals have given off practically all the gas in 10 weeks, some of them being exhausted of gas in 2 weeks, while the Illinois coals give off gas for a long period of time, one over a period of 40 weeks, another for 70 weeks. In the giving off of this gas part of the volatile matter disappears and naturally the coal loses something of its luster. It is interesting, however, to note that the Bureau of Mines, computing this loss, finds that on the Benton, Ill., coal, which experiences the greatest loss in volume of gas, the loss in heating value was only 0.16 of 1 per cent, so that the value as a fuel is not materially affected.

The other effect, that of absorbing oxygen, is more of a variable, and it is rather uncertain just what effect the absorption of oxygen has. In the case of the Pocahontas coal, during 10 months, the volume of gas absorbed was 4 times the volume of the coal. In the Harrisburg, Ill., coal, during 9 months the volume taken in was 2.8 times the volume of the coal; for the Sheridan, Wyo., coal, during 7 months the volume absorbed was 4.4, and for the Benton, Ill., coal the volume absorbed in 17 months was 6.9 times that of the coal.

The experimenters have concluded that the oxygen is probably taken into chemical combination rather than being absorbed by the coal or gathered at the surface, because a sample of the coal which was boiled in water in a flask after combining with oxygen equal to nearly 7 times its own volume, threw off in boiling no oxygen more than that contained in the air in the

sample. If the oxygen had been simply absorbed or gathered on the surface of the coal, the boiling should have thrown it all off. There is, therefore, a considerable oxidation of coal by this process, but no estimate was made of the percentage of loss.

While the loss from the giving off of gas is comparatively small so far as the heat in the coal is concerned, it does form an element of danger in that, if the coal be stored in a confined place, there will be



an accumulation of explosive gas which, in the case of spontaneous combustion or ignition from other cause, may be disastrous. Storing of the coal in an open bunker where the gas can escape as formed will, of course, remove this danger.

WITH STEEL WORKS ENGINEERS

PENNSYLVANIA STATE MEETING AT JOHNSTOWN.

NOT large in numbers, but long on enthusiasm, the convention gave promise of a bright future and large growth.

Beginning with the Friday morning session, at which Mayor Johnson gave an earnest, friendly greeting, there was harmony and good fellowship throughout, and the finest of hospitality. Chairman Leitenberger of the local committee gave a brief history of the lights and shadows in the life of Cambria Association of Johnstown and was followed by Messrs. Garlick and Carney telling of the good work done, of the benefit of state meetings and the efforts made for and great need of a state license law.

After appointment of committees, the meeting adjourned to the exhibit hall, where Past President Carney opened the exhibit with happily worded expression of the community of interest of engineers and exhibitors.

Visit to Cambria Works

AFTER luncheon some time was spent on reports and at 3 o'clock all were taken on special cars to visit the huge works of the Cambria Steel Co., where some 18,000 men are employed.

The great yards for storage of ore and fuel, machinery for handling materials a carload at a time, blast furnaces, rolling mills, shops and power plant furnished plenty of subjects for study, thought and wonderment.

The Banquet

A FINE menu, attentive service and a novelty in the way of good music made the evening one of great enjoyment. The Croatian Orchestra was composed of local players, mostly workers in the mills, and each player had made his own instrument.

National Treasurer Forse acted as toastmaster, introducing Mr. Yoho, the first president of the state association, Past National Presidents Garlick and Carney and others. A pleasant incident of the afternoon was the voting to Messrs. Yoho and Forse past presidents' jewels in appreciation of their work for the association.

Exhibits and Exhibitors

TASTEFUL arrangement and decoration of spaces had been provided by the convention committee and a good representative showing of power plant supplies was made.

PALMETTO PACKINGS for steam, Manhattan for water, Greenet gasket tubing and the Favorite ratchet wrench were displayed for Greene, Tweed & Co. by its representative, B. M. Bulkley, and described in a new catalogue entitled "Steam Specialties That Have Won Their Way by Merit."

LUNKENHEIMER PRODUCTS, including Renewo globe valves, Victor gate valves, oiling devices, carbureters and other brass goods filled the space of The Lunkenheimer Co., in charge of A. W. Dodds.

TRILL INDICATORS with reducing wheel, cord take-up and device for giving a continuous diagram record 200 ft. long were shown by W. L. Trill of the Trill Indicator Co.

P. P. P. CUSHION rod packing, Skihi, Ebonite, Edgewater cloth insertion and Hercules sheet and the numerous other brands of the Quaker City Rubber Co. formed a complete line for all purposes and services, as explained by H. H. Longwill.

JENKINS BROS. showed the familiar Jenkins valves with renewable disc, distinguished by the diamond trademark, also blow-off cocks, valve discs, '96 and Overland sheet packing and '96 tubular gasket. J. T. Bulkley of Philadelphia looked after visitors.

JOHN W. VANCE was in command of the Tauril packing exhibit for the Anchor Packing Co. and kept the visitors busy.

CLEARNESS OF OILS and uniformity of composition was shown by the flow of air bubbles through the tubes at the Atlantic Refining Co.'s space. Oils for cylinders, bearings and automobiles, Polarine and Zerolene brands, were among those demonstrated. R. H. Shafer, Chas. H. Garlick. W. K. McHenry and Edward Schluederberg were the air manipulators.

SHEET, SPIRAL, SQUARE and round packings of the Black Hawk, Paramo, Shawmut and Usudurian brands, made by the Revere Rubber Co., were displayed by J. W. Lawrence of the Pittsburg office.

IN HEAVY MACHINERY the Epping Carpenter Co. showed a 7.5 by 5 by 10-in. end packed, pot valve boiler feed pump, having a steam valve of piston type with packing rings to take up wear. The details were explained by Floyd F. Woods.

ANDERSON TRAPS for high or low pressure, and particularly the Model D with removable and interchangeable valve and float, also all sizes of the Anderson special reinforced float were demonstrated by Charles H. Fiske, representative of the V. D. Anderson Co.

STEAM SPECIALTIES shown by the John F. Robertson Co. were McCord Lubricators and McKim gaskets made by the McCord Mfg. Co., Franklin oil filters, S. C. Feedwater regulator and pump governor, S. C. gage cocks, Kinghorn pump valves, Little Giant tube extractor and Little Giant steam trap. Mr. Robertson was in charge.

SWANK HARDWARE CO. of Johnstown, acting as agents for the Home Rubber Co. and H. W. Johns-Manville Co., had a large display of N. B. O. and O. I. M. packings, with Chas. H. Swoger of the Home Co. as demonstrator; and of Kearsarge and Permanite gaskets, electrical specialties and pipe coverings with J. C. Lockhart and W. B. Halen of the Johns-Manville Co. in charge. Other specialties were Detroit Lubricator Co.'s oiling devices for cylinders and bearings, and Crane Valves. H. Fordott represented the Swank Co.

WAVERLY OIL WORKS showed samples of air-compressor, cylinder, gas-engine and special oils, in charge of L. H. Hart.

CITIZENS' LIGHT HEAT & POWER CO. had an attractive display of General Electric Co.'s specialties for lighting systems and for home and factory use, including lamps and fixtures, motors, domestic utensils, etc.

BALBROOKE CO. made an excellent demonstration of what Morehead traps, made by the Morehead Mfg. Co., can do, also of the merits of Ohio grease for cylinder lubrication and of the Ohio cylinder lubricator for feeding grease. J. C. Ross acted for the Ohio Grease Co. and A. E. Arthurs for the Balbrooke Co.

WM. C. ROBINSON & SON CO., of Baltimore, gave an excellent illustration of the progress of oil from the crude to finished

lubricants by means of sample jars of the different stages. Some of the brands were Ammonid, Turbine, Dynamo, Hydrangea, Decus and Special Valve. Other lubricants were Greoil, nonfluid oil and Lubrantine grease. P. A. Patterson acted as information dispenser.

LAGONDA AND WEINLAND specialties, shown by the Lagonda Mfg. Co., included models of Weinland cleaners for all kinds of boiler and condenser tubes and descriptive literature on the automatic nonreturn valve and Enterprise strainers.

LIBERTY MANUFACTURING Co. and the Eliot Co. were represented by H. A. Pastre of Pittsburg.

FOR THE GARLOCK PACKING Co., T. M. Green and Wm. B. Rogers were active agitators.

A. J. HAWS & SONS displayed a complete line of fire brick for settings, arches and baffles, of clay, silica and magnesia varieties. Edward Boes did the honors.

JOHNSTOWN SUPPLY HOUSE presented a barrow load of check, globe, gate and angle valves made by Jenkins Bros.

GEO. M. NEWHALL ENGINEERING Co. illustrated the action of its Vance steam trap by means of a large sectional model, showing details of valve and bucket.

PRACTICAL ENGINEER was represented by the editor, Arthur L. Rice.

WHAT HAPPENED IN OTTUMWA

DOINGS OF IOWA STATE ENGINEERS IN CONVENTION.

"WE TAKE pleasure in inviting you." That's the way the program started out, and it was the truth. At any rate the "entire membership" of the Ottumwa association was on the reception committee and they kept busy and made good.

Things started on Thursday, May 25, and kept moving; beginning with the welcome to the city by Mayor Harper followed by other addresses of welcome and responses, a trip of inspection to the big Morrell packing plant and the liveliest kind of an evening smoker.

Friday morning was taken up with routine business and reports of committees among them that on license law. The attempt of last winter was not successful, due to disagreement among engineers as to its desirability. Also it was thought that the bill must provide its own means of support for the examining board. The recommendation was that effort, for the present be turned to city ordinances, but others were of the opinion that continued effort could in time pass the law, perhaps not in one year, but eventually.

Secretary Raven expressed the opinion that the time had come when help of the national body toward passing state license laws would soon be available.

Discussion on place of meeting resulted in choice of Sioux City for 1912.

Petroleum Products

THIS was the title of the address delivered by W. A. Converse of Chicago, on Friday afternoon, the talk being illustrated by samples of grades of crude oils and refined and by views of testing apparatus and scenes in the oil fields. The substance of the lecture is contained in the articles by Mr. Converse which have recently appeared in Practical Engineer.

Following this, by courtesy of Mr. Stossel of the local committee, all hands atended the ball game and had the satisfaction of seeing the Ottumwa boys win.

After the evening banquet so acceptably served at the Ballingall Hotel, Mayor Harper acted as toastmaster to introduce Secretary Raven, Mr. Doolittle, and other speakers who discussed the objects of engineers' meetings and the effect of license laws.

On Saturday

AFTER a short business session, Mr. H. H. Dewey of General Electric Co., spoke on Alternating Current Machinery. He described the method of connecting up a plant and analyzed the action of machines, explaining how the demand for fine voltage regulation carried with it high short circuit current and likelihood of large surge currents between machines run in parallel, if the prime movers do not regulate speed quite in unison.

He showed advantages of automatic switches in the generator mains in protecting the armature from short

IOWA ENGINEERS AT OTTUMWA

circuit on the bus-bars or leads; and disadvantage in possibility of throwing out all generators because of one short circuit on an outside line.

Many machines were described and illustrated by lantern slides and their uses explained including the use of the synchronous motor to improve the power factor in a system by driving a machine having constant load such as an air compressor or centrifugal pump and overexciting the motor field producing a leading current and neutralizing the effect of induction motors which tend to draw lagging current thus cutting down the power capacity of line and generators. This may be carried even to the point of running a synchronous motor idle with overexcited field solely for the sake of producing condenser effect to neutralize the induction of transformer and other load and raise the power factor of the system.

A visit to the Ottumwa Iron Works occupied part of the afternoon and a business session the rest.

The Show

THIS was handled by the Central States Exhibitors Association and was a credit in every way, the signs furnished for the booths being especially artistic and attractive.

AMERICAN STEAM GAUGE and Valve Co. exhibited outside spring Thompson Improved indicator and reducing wheel, also recording gages, an opened double-spring, gage, gage tester, a sectioned American pop safety valve, and a line of Ellison specialties. Chas. C. Kilander, Manager of the Chicago office was in charge.

STANDARD OIL Co. was represented by F. M. Williamson of Cedar Rapids, and Frank Whitney, the local representative.

HULSON GRATE Co. showed a model of its grate and samples of bars, shaker parts and bearer. It is so constructed that with ⅜-in. opening it gives 55 per cent air space and with ½-in. openings, 72 per cent. A. W. Hulson, the inventor, was the representative.

TAURIL sheet packing, pump discs, braided metal covered and all metal packings, fibrous and rubber packings for all purposes, were included in the exhibit of Anchor Packing Co., arranged by W. E. Elphick, of the Chicago office.

STOSSEL OIL WORKS was represented by A. F. Stossel and Theo. Stossel.

CRANDALL PACKING Co. showed flax packings in round and square, diagonal, cushion and lip forms in rubber, copper covered and combination materials, and metallic ring for rods and rotating stems. Asbestos gaskets and sheet were also shown and explained by A. J. Page of Chicago, in charge.

THE LYONS BOILER model, handled by W. P. Lyons evaporated quantities of water regularly but refused to explode even when urged.

C. K. SHERMAN, representing the Underfeed Stoker Co. of America, illustrated the action of the Jones Stokers by means of blueprints and told how the order came to "stop it" (smoke) and how Jones did.

MURRAY IRON WORKS Co.'s products from catalogs, in themselves pleasing, were most attractively displayed by H. M. Jones, of Des Moines. The "cut your bills in half" emblem was a prominent feature. J. A. Dailey and E. C. Denz were also present for the Murray Co.

HILLS-MCCANNA Co. ran a flower show in its booth and a picture gallery filled with photographs from many plants showing installations of its square and round type oilers. Robt. E. Hills was the "flowerist."

PEERLESS PRODUCTS as made by the Peerless Rubber Co., and displayed by Geo. B. Carpenter & Co., included Success spiral cushion with Rainbow core, Eclipse tubular gasket, Peerless belting and hose, Rainbow sheet and other brands. C. A. Elliott was the man.

THE DEARBORN FERNERY formed an attractive setting for the instructive books on Treatment of Boiler Feed Waters which were distributed by W. A. Converse, chemical director, F. C. Gibbs and O. P. Poole.

LUBRIKO CUP and cylinder grease was displayed by J. C. Dickover of the Commercial Lubricating Co.

RENEWO VALVES in gate, globe, and angle form, gate valves, blowoff valves, brass lubricating specialties and pop safety valves were shown by the Lunkenheimer Co.'s representatives, E. P. Gould and C. C. Rodenberg.

HAWKEYE boiler compound, was kept to the front by H. E. Tibbles, Jr., W. O. Tibbles, John L. Clarke and R. M. Rochefort.

E. R. STUBBS represented the Viscosity Oil Co.

JOHNS-MANVILLE products as displayed by W. B. Roberts, showed the wide field of the company's activity; they included enclosed fuses, waterproof sockets, J-M pipe coverings, Kearsarge asbestos gasket and sheet packing, Permanite graphited sheet and cut gaskets, spiral and compound ring forms for steam and water.

MCMASTER-CARR SUPPLY Co. was represented by R. H. Rawson.

PENNSYLVANIA OIL AND SUPPLY Co.'s booth contained Penn Silver Leaf specialties for engine lubrication, gas engines, ice machines, valves, air compressors, dynamos, etc. C. R. Considine was the exhibitor.

OSBORNE HIGH PRESSURE Joint and Valve Co.'s globe and angle valves were present in sizes from 3-in. down; also flange joints, all in charge of C. M. Schneider.

STRONG, CARLISLE AND HAMMOND Co.'s interests were handled by W. P. Owens.

S. C. REGULATOR Co., represented by J. I. Wernette displayed its familiar feed water regulator and pump governor, and the new S. C. gage cock.

TRAPP AUTOMATIC CONTROL of ammonia pressure on ice machines was explained by E. E. Trapp, of the Trapp Pressure Control Co.

WESTERN BOILER COMPOUND and Chemical Co. was represented by F. Joe Deady.

JENKINS BROS., showed the '96 sheet, Overland sheet, '96 tubular gasket packings, and the Jenkins renewable disk valves in stops, angles, checks, and y's, all bearing the diamond trade mark. Joseph Williamson was the moving spirit.

OTTUMWA IRON WORKS showed descriptions of mine fans, electrical hoists, sheaves and hoisting engines.

GARLOCK PACKINGS were shown in the usual exhibit of the company by A. F. Sheldon.

GREENE TWEED & Co.'s Palmetto twist, round and square, and Manhattan square were displayed by Geo. A. Hawkins.

KENTUCKY ENGINEERS

AT THE LOUISVILLE CONVENTION

FOLLOWING the successful exhibition at Ottawa in May, the Central States Exhibitors' Association moved down to Louisville, Ky., to convene with the Kentucky State Association of Stationary Engineers in their ninth annual meeting at Liederkranz Hall.

A large delegation of officers and visitors was present at the opening session. C. E. Fertig, chairman of the convention committee, officiated. The invocation, delivered by Rev. J. H. Young, was followed by an address of welcome by Mayor Head. The address of State President Frederick L. Ray was followed by the royal welcome of R. W. Brown, Secretary of the Louisville Publicity League, and the reply to Mr. Brown was given by Osborn Monnett of the Central States Exhibitors' Association. The preliminary program closed with an address by F. W. Raven.

The formal opening of the exhibit followed the morning's session, and was attended by more good fellowship than ceremony.

After the business session in the afternoon, the delegation of engineers throughout the State came back to the hall to talk with the exhibitors and see the new things presented. This was followed by a smoker given in the evening by the Central States Exhibitors' Association.

Saturday morning was taken up in the exhibit hall, which was followed by a regular business session, hearing reports from the various committees of the N. A. S. E., and the election of officers of the Kentucky State Association of Stationary Engineers for the ensuing year as follows: President, J. H. Oelze, Owensboro; Vice President, J. L. Shrode, Hopkinsville; Secretary, J. L. Harpole, Hopkinsville; Treasurer, Edward Kockenrath, Louisville; Conductor, C. Carroll, Louisville; Door-

keeper, William Cummings, Henderson; State Deputy, J. N. Draper, Henderson.

Owensboro, Ky., was chosen as the city of the next convention which is to be held on the first Friday and Saturday in June, 1912, unless the dates are extended to include a 3-day session instead of 2, as is now the custom.

After the election of officers, the delegates and visiting members were the guests of the Louisville Convention and Publicity League at a one-o'clock luncheon at the Williard Hotel. Immediately following the luncheon they were taken from the hotel on an automobile ride to the Louisville Light Company, the Louisville Power House and through Cherokee Park by the Convention and Publicity League.

The convention program closed with a moonlight excursion up the Ohio River on the Steamer Columbia,

KENTUCKY ENGINEERS AND FRIENDS AT LOUISVILLE

where the delegates were guests of Lodge No. 1 of Louisville.

Notes on the Exhibit

THE exhibit was one of the most elaborate ever given in Kentucky and attracted wide attention outside the ranks of the members of the association. Several novelties as well as familiar lines were shown in the exhibit hall.

THE DEARBORN DRUG & CHEMICAL WORKS had its booth attractively decorated and furnished each visitor at the booth with a little memento which served as a reminder of the company. Representatives present were Wm. O. Clark and W. A. Converse.

CRANDALL PACKING CO. had its booth arranged very conveniently, showing its full line of fibrous packing, flax rings, square and cushion packing, and its new metallic packing. Representatives in charge of the company's interests were E. F. Briggs and F. M. Wheeler.

THE INTERESTS of the H. W. Johns-Manville Co. were taken care of by E. F. Bohne and J. R. Chowning. Many specialties were included in their showing. The principal departments covered were the asbestos and rubber packings, pipe covering of the air cell, asbestos and magnesia type, and cork insulation for the refrigerating plants.

LUNKENHEIMER CO. had its sample valves very attractively arranged for the spectator. Representative Jos. H. Hewetson presented each visitor with a Lunkenheimer charm (which is familiarly called the glad-hand).

HILLS-MCCANNA CO., of Chicago, represented by Robert E. Hills, showed its force feed lubricator pumps, high pressure gage cocks and low water alarms.

W. H. NEILL CO., mill supplies, also local representatives for Greene, Tweed & Co., presented an attractive display of engine room specialties which they handle, and include so many different lines that it is impossible to describe them all.

WICKES BOILER CO., of Saginaw, Mich., represented by James Milne, showed a model of their boiler in working operation, which attracted wide interest.

CHAS. C. STOLL OIL CO. was represented by George J. Stoll.

JAS. CLARK, JR., ELECTRIC CO., manufacturers of dynamos and motors, was represented by W. W. Crooker.

UNITED STATES GRAPHITE CO., represented by Ralph O'Brien, emphasized the value of its graphite products.

STRONG, CARLISLE & HAMMOND CO., represented by Homer Whelpley, combined with its local representative, E. D. Morton & Co., showed mill supplies in a very attractively arranged booth which contained the products of the Strong, Carlisle & Hammond Co. and the various articles handled by E. D. Morton & Co.

HAWK-EYE COMPOUND CO., Chicago, presented each engineer with a treatise on its compound and very attractive circular matter.

THE WM. POWELL CO., of Cincinnati, was represented by Charles Cullen, who described the advantages of Star valves.

THE GARLOCK PACKING CO. was represented by M. E. Becker.

THE STANDARD OIL CO. was represented by J. D. Clark, showing the light and heavy oils attractively.

LAIB CO., of Louisville, was represented by J. L. Strouse, who entertained the visitors and explained the wide assortment of engine room supplies handled by the company.

HENRY VOGT MACHINE CO. was represented by Henry Vogt and G. T. Ellis, who explained the water tube boilers with its special features of compressed steel construction. The small model shown was a replica of its 300-hp. boiler.

OSBORNE HIGH PRESSURE JOINT & VALVE CO. was represented by Mr. Osborne.

JENKINS BROS.' interests were taken care of by B. R. Wofford, showing samples of the well known Jenkins valves and pump disks and the old familiar '96 sheet packing and tubular gaskets.

MORAN STEAM FLEXIBLE JOINT CO., of Louisville, was represented by Joseph Ganz.

KENTUCKY CONSUMERS' OIL CO., of Louisville, was represented by T. Schroeder.

R. B. CAMPBELL represented the National Smoke Preventer Co., of Louisville, who distributed many of the valuable booklets entitled "Stop the Smoke."

THE STERLING COMPOUND CO. was represented by Geo. W. Hinesley.

OTHER COMPANIES having booths were Ahrens-Ott Mfg. Co. of Louisville, Lyons Boiler Works of De Pere, Wis., and Joseph Walton & Co.

THE V. D. ANDERSON CO., Cleveland, was represented by J. H. Meyer, who presented literature on its oil filters and traps and entertained visitors generally.

J. J. REILLY MFG. CO., Louisville, showed the practicability of its pumping machinery by booklets and facsimile apparatus. Louis W. Kerberg presided at the booth.

ANDREW COWAN CO., of Louisville, was represented by D. S. McElroy, who also looked after the interests of the Ohio Grease Co.

THE HOME RUBBER CO.'s interests were looked after by Chas. F. Greene.

POWER was represented by Osborn Monnett.

PRACTICAL ENGINEER'S booth was presided over by C. L. Bates.

IT HAS BEEN estimated that a badly designed muffler or silencer, or poorly arranged exhaust pipe will waste 15 to 30 per cent of the power of an internal combustion engine.

ADVERTISING IS JUST a matter of good mediums, good arguments and good sense.

A TRIUMPH IN NEWARK

STATE CONVENTION

NEW JERSEY outdid herself and the New Jersey boys are justly proud of the showing made. From the opening of the exhibition on Friday afternoon until the close of the inspection trips on Sunday evening, there was a big attendance and lively interest; and the whopping big exhibit was ample evidence that there had been lively interest for many months past in gathering such a representative display of power plant appliances and machinery.

As Mayor Haussling was unable to be present, acting mayor, John Donnelly, president of the common council, formally opened the exhibit at 8 o'clock on Friday evening. The hall had been opened to the public during the afternoon, but was formally opened in the evening, and an entertainment given by the

NEW JERSEY DELEGATES AND VISITORS

New York bunch, under the management of Frank Martin. A large attendance throughout the evening thronged the exhibits and kept supply men busy.

Saturday Happenings.

SATURDAY morning the exhibition was opened early and was well attended through the morning hours by delegates and friends gathering for the afternoon session. Saturday afternoon the convention was opened with speeches of welcome, and the appointment of committees was made, followed by the reports of some standing committees. The session then adjourned to meet on the morning of the 4th, and the engineers busied themselves with the exhibit until evening and time for the banquet, which was given to delegates and exhibitors at the Continental Hotel. At this feast the attendance was so large that the big dining room was more than filled and a good-sized overflow was held in the small dining room.

Disposing of the material blessings, attention was given to speeches of welcome and of response by the city officials and by the national and state officers of the association, interspersed with songs and monologues by popular entertainers. The occasion kept the large gathering practically unbroken until the wee small hours.

Speeches and Elections.

ON the morning of the 3rd, State President Edward W. Sears called the meeting to order, and after reports of some committees he introduced National Vice President Kearney, who complimented the State Association on the fine appearance of the convention, and spoke of what has been expected of the engineers in the past, and the duty of each man to himself and to the association. Considerable discussion on the place of meeting resulted in Newark being chosen as the place for 1912, and election of officers resulted in the choice of State President, W. Crouse, of Passaic; Vice President, Martin Hickey, of Jersey City; Secretary, Charles Sumner, of Hoboken; Treasurer, A. Brown, of Newark No. 3; Conductor, James F. Heath, of Elizabeth; Doorkeeper, Thomas McNamara, of Paterson; State Deputy, John T. Jenkinson, of Paterson.

Following the election and installation of officers an impressive memorial service, for members deceased during the past year, was held, during which all present stood and the names of deceased members were read, with remarks from any who chose to speak as the roster proceeded.

Resolutions of thanks were passed to the committee who had charge of the convention, to the supplymen, and to the officers of the city.

A past president's jewel, commemorative of his good work for the State Association was given to Edward W. Sears, the retiring president, who richly deserved it for the success that he had achieved for the convention. The vote was passed that the secretary be empowered to procure a gavel to belong to the State Association, and also that he procure a United States flag to be used at each convention, these articles being properly a part of the equipment of a State Association. Committees were then appointed for next year and the convention adjourned to spend the rest of the day in inspection trips to power plants about the city.

A Big Exhibit

ANOTHER jump such as was made from 1910 to 1911, and the New Jersey State exhibit will rival that of the National Association. Everyone was surprised at the number of exhibits, the beautiful arrangement of the exhibit hall, and the big attendance of the visitors.

VISCOS BRANDS of oils, a non-flowing oil, and motor greases were displayed by the National Oil & Supply Co., represented by C. P. Gulick, and A. Phillips.

AMERICAN STEAM GAUGE & VALVE CO., showed the American pop safety valve in sectional models, and also the American Thompson Improved indicator outfit with reducing wheel and air or steam driving, and the Weinland reseating machine for reseating the caps in water-tube boilers.

W. B. MCVICKER CO. of New York, chemical engineers and specialists in lubricating oils, boiler compounds and elevator lubricants, were represented by John J. McDonald.

MODEL D STEAM TRAP with removable valve, was shown in section by the V. D. Anderson Co., of Cleveland, O., which also displayed a small model of a working trap. The representative, H. S. Meacham, of the Philadelphia office, and S. C. Webster, explained also the working of the Anderson engine room oil filter, which filters the oil through regulation filter paper.

THE NORBEN OIL & SUPPLY CO., of Warren, Pa., exhibited Norbenene Grease and nonfluid oil, and was represented by Wm. J. Norman and Charles Hicks.

VIEW IN THE EXHIBIT HALL AT THE NEW JERSEY CONVENTION

top motion, American gages and gage testing set.

FOR THE ASHTON VALVE CO., Chas. W. Buckelew and Chas. W. Ulrick, arranged an exhibit including the Ashton Improved blow-off valve, the Ashton recording gage, a section of the Ashton Lock-up pop safety valve, gage testers, pressure and vacuum gages, gage springs with single and double arms, and the Ashton bubbling drinking fountain.

R. & J. DICK, LTD., showed the Dick Balata belting, Dick belt, Jackson fasteners, and samples of leather belts, which have been running in water since November 9, and are still in the best of condition. H. L. Conover, P. E. MacKenzie, and E. W. Church, represented the company.

ROBERT M. PHILLIPS of the Hewes & Phillips Iron Works, displayed photographs of different installations of the Hewes and Phillips engines, and explained the action of the dash pot and valve operated by the Franklin releasing gear, the same as used on the Hewes & Phillips Corliss engine.

PALMETTO PACKINGS for dry and superheated steam, and Manhattan Packings for hydraulic work were shown in all styles and for all purposes, including round and square, braided and twist, by Greene-Tweed & Co.'s representative, Geo. R. Starrs.

THE NEW YORK BRANCH of the Lagonda Manufacturing Co., of Springfield, O., represented by M. O. Lewis and W. R. Danley, exhibited the Lagonda Enterprise strainers, the Lagonda automatic nonreturn stop valve, the Weinland tube cleaners for

DAVIDSON PUMPS were shown by the M. T. Davidson Co., 154 Nassau St., New York, the display being in charge of Wm. E. Brennan, representative, and in the same booth Cochrane Heaters were shown by F. E. Idell of 50 Church St., New York, the representative being W. W. Montalvo, Jr. Special attention was called to the simplicity of the Davidson Pump, and to the new design of Cochrane steam stack heater, made by the Harrison Safety Boiler Works

WIRE ROPE samples were displayed in a booth fitted up as an attractive resting spot, by the John A. Roeblings Sons Co., J. W. Troescher, representative.

CLEMENT RESTEIN CO. showed Belmont packings for general use, and the style No. 19 hollow packings for special uses. The representatives present were P. H. Cumings, and Ralph Henry, manager.

THE EVER POPULAR Dick Foley and Thomas Siddall were in charge of the booth of the Home Rubber Co., and displayed the N. B. O., the Red Rose, and the O. I. M. sheet packings as well as a complete line of other styles.

STANDARD REGULATOR CO., of New York, exhibited the Victor damper and hot water regulators, also devices for regulating temperature, pressure, humidity, as might be required. Full size regulators were shown, and also some models. Representatives were Fred H. Davis, Sr., and Fred H. Davis, Jr.

LUDLOW AND SQUIER, distributors of power plant supplies and

machinery, acted at the convention as representatives of the J. H. Williams Co., showing the Vulcan Wrenches, of the Toledo Pipe Threading Co., showing pipe threading machinery of the Vanda Co., displaying Vanda packings of the Wright Mfg. Co. and the Austin Separator Co., showing the Austin and Wright steam specialties, of the Parmelee Wrench Co., showing the improved Parmelee Ratchet Wrenches and of the Beaver Die Stocks and dies. The representatives were S. W. Jones and W. J. Morrow. At this booth were also shown the Detroit Lubricators, the Metropolitan Injectors, a display of Albany Grease, of the Stephenson Belt Dressing and of Smooth-On Iron Cement.

JONES UNDER-FEED STOKER, made by the Under-Feed Stoker Co., of America, was explained by W. T. Jordan and Thos. Berth, by means of working aluminum model of the stoker and by records of the results and tests made on different plants equipped with Jones stokers.

HOMESTEAD VALVE CO., represented by Frank Boyle, displayed the Homestead Blowoff valves in all sizes, in both brass and iron, arranged in tasteful form and so that the action could be easily seen. This exhibit was in a double booth with that of C. E. Squires Co., as Mr. Boyle is also agent for the Squires steam specialties.

C. E. Squires was present in person, and exhibited his steam trap working under air pressure, and separating air from water without any leakage of the valve. He also displayed an aluminum model trap and a working model to be operated by hand, having a valve opening of only 1-32 in. diameter, and which operated perfectly. Besides the trap there was shown the Squires feed water regulator and pump governor.

KENNEDY VALVE MANUFACTURING CO., of Elmira, N. Y., showed a full line of gate, globe and angle valves in bronze and iron, the gate valves having the special double disc to insure tight closing. The representative was William Martin, New York manager.

THE MUTUAL SUPPLY CO., of New York exhibited Steel Mixture for boiler furnaces, White Star Valves made by the William Powell Co., the product of the Ohio Grease Lubricant Co., and brass specialties made by the Wm. Powell Co. The representative was P. L. Bailey.

INTERNATIONAL ACHESON GRAPHITE, and the method of using it in Gredag, Oildag and Aquadag, also a model of the furnace showing how the graphite is made, was shown by the International Acheson Graphite Co., represented by G. M. Barnes and Richard Cary.

A FULL SIZED Yingling Shaking Grate was shown by Chas. Yingling & Son, of New York City, and the operation was illustrated by the representatives, Chas. Yingling and Chas. H. Yingling.

DAVID C. SEYMOUR was present at the convention in charge of his exhibit of photographs of boiler stacks and tanks, and was also represented by I. J. Ingram. Mr. Seymour is also agent for the Continental boiler.

THOMAS X. LIEB, representing the Mueller Mfg. Co., explained the features of its reducing valves, and also showed the White Star valves, made by the Wm. Powell Co., and other brass specialties for lubrication work.

GARLOCK PACKING CO., showed samples of all sorts of packing including the No. 900 fibrous, and the Palmyra sheet packing, and also asbestos and metal-covered packings for various purposes. The representatives were W. S. Elberson, J. F. Wallace, and F. P. Morton.

OTIS ELEVATOR CO., a new exhibitor at conventions, showed a line of leather cup packings for cylinders, valves and rods, and also a large line of lubricants for elevators, elevator guides, gears and bearings. The exhibit was in charge of A. L. Starkweather and John Keenan.

THE BABY CASCADE pumping outfit, including an electric motor and Dixon Cascade centrifugal pump, was shown by the Dixon Cascade Pump Co., represented by Ralph Dixon, President. This little pump, which occupied only a half square foot of floor space, had a capacity of 30 gal. per min. and was driven by 1/6-hp. motor.

GRISCOM-SPENCER CO., represented by S. S. Schaeffer, Wm. P. Cook, Jr., and Wm. Kunz, exhibited models of the Goubert and Reilly closed feed-water heaters in sectional model, a Stratter steam separator, full size, and sample coils as used in the Reilly heater.

CRANE CO.'s specialties, including a case of valves, pipe bends of different sizes, the Cranetilt trap, the Crane bucket trap, whistles and brass specialties and different brands of packings, was represented by W. L. Oswald, F. L. Forsythe, H. Houndslea and E. Sink.

CLING-SURFACE and what it will do was shown by the Cling-Surface Co., the model of comparative belt pull available for power transmission with a belt untreated and treated with Cling-Surface. C. N. Tillotson and Chas. F. Chase explained the value of Cling-Surface as a "life saver for belts."

MOREHEAD TRAPS, particularly the condensing steam return trap, were exhibited by Ross & Taggart for the Morehead Mfg. Co. The members of the firm are J. G. G. Ross and Jas. M. Taggart, who presented reports of the savings accomplished by means of Morehead traps.

LIP PACKING for hydraulic plungers and rods was especially emphasized by the Crandall Packing Co. in its exhibit, which also included a case of samples of different styles of packing. In this same booth the representatives, A. J. Jaeger and Wm. Cashell, showed the Roto boiler tube cleaner.

THE PIPE BENDING DEPARTMENT of the John Simmons Co., known as the Simmons Pipe Bending Works, showed a line of Marsh quick opening double seated valves, which takes only 1½ turns to open and have seat at top and bottom, welded nozzles and bends, valves with iron bodies, samples of bends and coils made by the company, Beaver die stocks and dies, the Vulcan pipe wrenches made by J. H. Williams Co., and the Rothschild blowoff valve. The representatives present were A. R. Milne, Jr., and F. Sonnekalb.

NEW YORK BELTING & PACKING CO., represented by Chas. A. Wilhoft, manager, F. S. Cole, F. N. Anderson and Arthur C. Reed, showed samples of its complete line of packings, including the Firo for superheated steam, indestructible sheet, the Cobbs expansion packing for rods, the Graphon spiral and ring, the Turxo for rods and valve stems.

IN THE EXHIBIT of the Nathan Mfg. Co. a new style of valve was shown which attracted much attention. This was the Hart, invented by Walter Hart, who was explaining it to visitors. It has a disc free to seat itself independently of the stem and held to place by pressure at a single point. The disc is reversible and can act as a check valve as well as a stop valve. Other features of the Nathan exhibit were injectors, lubricators, oil cups, etc., shown by Edward J. Scully.

PHILADELPHIA GREASE MFG. CO. displayed Philadelphia greases and oil cups, including the Jackson crankpin grease cup represented by Richard D. Jackson.

H. H. LIND and H. H. W. Bergmann represented the Ohio Blower Co., with the Swartwout automatic gage glass, Swartwout cast-iron exhaust heads and especially the Swartwout rotary ball bearing ventilator which shows on test extremely high capacity.

STEEL-MIXTURE blocks, shapes to form front and back arches and a model boiler setting were displayed by the McLeod & Henry Co., the exhibit in charge of John H. Foote and Frank B. Tuthill.

HAMPSON & MARKS, agents for the American Ball engine in New York territory, exhibited blue prints showing sections of the engine and photographs showing installations; in charge of Harry J. Marks.

THE LUNKENHEIMER CO. displayed its full line of brass specialties, including oilers, whistles, valves, lubricators, steam traps, oil pumps, etc. W. A. Reynolds represented the company at the convention.

THE ILLUMINATED REVOLVING FOUNTAIN at the booth of the Dearborn Drug & Chemical Works, attracted much attention and was surrounded with comfortable chairs for the convenience of visitors. J. W. Wilson and Gilbert H. Reilly did the honors of the company at its booth.

ROCHESTER AUTOMATIC LUBRICATORS, made by Greene, Tweed & Co., were shown in 2-gal. 8-feed, ½-pint 1-feed, round body types, and circulars showing other types were presented by the representatives, A. C. Widman, R. J. Shelly and W. R. Platt.

RUSSELL BONNELL, general manager, and Thomas Oakes of the Nelson Valve Co., exhibited a line of brass and iron body valves in globe, check and angle types.

KEYSTONE LUBRICATING CO. exhibited its full line of different numbers of Keystone Grease and grease cups for all purposes. It was represented by J. M. Potts and H. H. Yates.

THE EXHIBIT OF THE Standard Oil Co. consisted of tubes showing the freedom with which air bubbles passed through the uniform density oils for different purposes. There were also samples of oils of different grades, the purposes of which were explained by the representatives, J. F. Kellers and Geo. W. Stitcher.

THE IRON WORKS CO., represented by Paul F. Crowe and J. Edgar Jones, showed the Crowe chain grate stokers and sample bars as used in these grates.

LIPPINCOTT INDICATORS and reducing wheels, 3-way cocks and indicator specialties, were shown by the Lippincott Steam Specialty & Supply Co., represented by A. C. Lippincott and Percy Scoby. In this same booth were found catalogs and illustrations of installations of the Keeler water-tube boiler made by the E. Keeler Co. Ambrose Dean was present, representing the Keeler interests.

JENKINS BROS. '96 sheet packing, the Jenkins valves and valve discs and the '96 tubular gasket packing, as well as the new Overland brand of sheet packing made up the display in

Jenkins Bros.' booth. The representatives were Frank Martin, Fred Murphy, Chas. B. Olson and Geo. Schmidt.

STRONG STEAM SAVERS, including Strong steam traps, separators, pump governors and engine stop, as made by the Strong, Carlisle & Hammond Co., were shown at its booth by the representatives, A. B. Pinney, O. L. Pinney and L. W. Pinney, of the New York office, and by F. H. Palmer of Cleveland. In the same exhibit H. Tenwinkle also showed a working installation of the Tenwinkle oil and water filter and extractor.

PEERLESS RUBBER GOODS, including the Rainbow packing, asbestos gaskets, Wizard asbestos sheet, Peerless hose, spiral packings and floor mattings, as made by the Peerless Rubber Co., were exhibited by Chas. F. Heitzmann, Frank E. Sass and Alfred Engle.

NATIONAL ENGINEER was represented by L. L. Rice, general manager.

WM. S. PITTS CO. exhibited a number of specialties, including the Northern safety water gage, the Durabla packings and gaskets, and Durabla gage and lubricator glasses as made by R. G. Von Kokeritz & Co., Ohio pressure reducing valves, made by the Ohio Brass Co., the Everlasting blowoff valve made by the Scully Steel & Iron Co., and the Barton automatic steam trap made by the Automatic Steam Trap & Specialty Co. Representatives present for Wm. S. Pitts Co. were Fred R. Morey, N. P. Hill, and for R. G. Von Kokeritz & Co., Jack Carson; for the Automatic Steam Trap & Specialty Co., C. L. Strong, of Cleveland.

ARMOR BOILER FURNACE equipment, including arches, side blocks, rear combustion arches, as made by the Greenpoint Fire Brick Co., were exhibited by F. H. Waite.

NEW YORK LUBRICATING OIL CO. was represented by Wm. Troy, sales manager, and displayed a line of Mono oils and Rena greases in different grades.

REPRESENTATIVES OF Power present were Chester Dibble, Jack Armour, Fred Johnson and F. F. Fyfe.

HENRY JOHNSON CO. displayed samples of Johnson sheet packings and also the Johnson sheet packing carrier.

W. S. SHEPPARD exhibited the working of the Philadelphia compressed air grease cup and also showed a line of Ideal greases, Graphoviscos for lubricating chains, Fibroviscos for lubricating automobile gears, and oils of different grades.

MILLARD F. SMITH represented the Ludlow valves, Jefferson unions in swing form and combined with valves and fittings, and the O. I. C. globe, angle and swinging check valves. Representatives present were J. B. Smith and M. C. Smith.

PRACTICAL ENGINEER was represented by Arthur L. Rice, editor.

H. B. UNDERWOOD & Co.'s display included crankpin turning machines, cylinder reboring rig, improved dashpot, St. John steam piston packing and safety ammonia compressor valves. Wm. C. Luckensmeyer and Hiram D. Griffin were the demonstrators.

IT HAPPENED IN ALBANY

THAT NEW YORK ENGINEERS MET

THE Empire state had its usual successful engineers' convention at Albany on the 9th and 10th of June. Friday morning found the delegates from New York promptly on hand, as they had come up from the metropolis on the night boat and the exhibit hall early became a scene of great activity, putting the exhibits in shape, fixing up the unfinished carpenter work on the booths and completing arrangements for the meetings.

The first meeting on Friday morning was devoted to the routine business, appointment of committees, etc., and to a report from the local committee on the preparations made for the convention. The afternoon was devoted to a visit to the State House, the Albany Institute and Museum and to a trolley ride through the suburbs, all of which were greatly enjoyed by the visitors.

Evening was left free for visiting the exhibits and was spent in that occupation by practically all the delegates and engineers in attendance at the convention. Saturday morning was devoted to discussion of the work that had been done on the license law, to the best course to be pursued during the coming year, to election of officers and other routine business. National Vice President Kearney was present and told of the slow progress made in other states on license legislation, and encouraged the New York association to keep up the fight.

In the course of his remarks, Mr. Kearney spoke of the growing importance of state conventions, of their value in carrying on the agitation for license laws and educational work and of the fact that 20 years' effort was necessary in Massachusetts before a law was secured and that it has been necessary to amend it nearly every year since, also that now the state has 25 examiners and boiler inspectors to look after the enforcement of the law.

The question of biennial conventions of the National Association was brought up, but was not favored, although it was suggested, and the suggestion endorsed, that the National Association contribute from its funds to give help to the state associations toward educational work and in the effort for securing license laws. A resolution was passed asking the National body to arrange for such assistance.

Discussion of the question of raising the per capita tax to provide a fund for legislative work, resulted in the decision that it was wiser to leave this raising of a fund until the actual need came for the money and then to get it by subscription rather than by assessment. A resolution was passed that the chairman of the committee on rules be requested to report the bill, which is now in committee, to the House for action, and this matter was placed in the hands of one of the delegates for prompt attendance on his return home.

Discussing the place of meeting for 1912, it was the sense of the convention that Yonkers would be an ideal location and that if the Yonkers association could arrange to care for the convention that would be the desirable meeting place. This was left to the incoming president and secretary to arrange.

Election of officers resulted in the choice of B. C. Dunsmore, of Buffalo, as president; Geo. O. Kaley, of Brooklyn, as vice president; E. E. Pruyn, of Rochester, re-elected secretary; Wm. Downes, Manhattan, treasurer; Harry Bache, of Syracuse, conductor; Jas. T. Fitzgerald, of Little Falls, as doorkeeper; Matthew Bender, Albany, as chaplain; and Jas. R. Coe, of New York, as state deputy.

Saturday afternoon was devoted to a boat ride on the Hudson and entertainment at Maple Leaf Island, and in the evening a banquet was given by the Chamber of Commerce and local body at Keeler's Hotel, at which entertainment was furnished by the familiar New York "bunch" of performers.

The Exhibit Hall

THIS contained a goodly display, several of the exhibits being entirely new in conventions and all of them being well planned and arranged.

JENKINS BROS. exhibited their regular line of valves and general supplies, including the quick-acting radiator valve, the '96 and Overland sheet packings, the Jenkins valve discs, steam traps and the '96 tubular gasket. Donnelly positive differential heating valves, for which Jenkins Bros. are now agents, were displayed. The representatives were Frank Martin, Geo. G. Schmidt and Mr. Rutz.

THE REPRESENTATIVES of Hill Publishing Co. were Chester W. Dibble and Jack Armour.

ALBANY GREASE, manufactured by the Albany Lubricating Co., in all grades and specially the Auto-transmission greases, were demonstrated by the veteran grease man, M. V. Peavey. W. D. Norton also assisted in proving that this grease was "all lubricant and no waste."

THE HOMESTEAD VALVE MFG. CO. showed a line of blowoff valves and of hydraulic and acid resisting valves made of composition metal. These were shown in straightway, 3-way and

4-way forms by Frank Boyle, of New York, who handles also the Nusbaum pipe and joint clamps and the Squires steam specialties.

IN THE BOOTH with Mr. Boyle was C. E. Squires, of the C. E. Squires Co., with an exhibit of the Squires trap operating to separate air from water and showing, by means of the full-sized trap as well as by the model, that it has tight valves.

COCHRANE HEATERS and Davidson pumps were shown in the booth of F. E. Idell Co., represented by F. B. Sage. Wm. E. Brennan represented the M. T. Davidson Co., and blue prints of the construction of the different apparatus, the arrangement and connection of the Sorge-Cochrane water purifying system, and literature on the pumps and heaters were distributed.

GEO. M. NEWHALL & Co. exhibited a sectioned model, full sized, of the Vance steam trap, showing the bucket action, the top discharge valve and the baffled inlet. The representative, Jas. A. Coutts, presented visitors with the Engineer's Reference Book containing much useful information.

SOUTHERN ENGINEER was represented by Frederick Dobie.

PHILADELPHIA GREASES, the Philadelphia compressed air grease cup, screw cups and the publication "Points on Lubrication," were distributed by Richard D.. Jackson, of the Philadelphia Grease Mfg. Co.

THE HOME RUBBER Co., represented by Thos. M. Siddall, presented its usual line of N.B.O., O.I.M. and Vesuvius packings for all purposes and in all different forms.

H. W. JOHNS-MANVILLE Co., represented by B. C. McClure and I. G. Jones, displayed its full line of packings and pipe coverings and emphasized especially the automatic piston packing known as J-M Sea Rings. This consists of a wedge of laminated asbestos, flax or duck, turned over on itself so as to give a cup form of packing, several rings being put in sequence and arranged so that the steam pressure tends to open up the cup and increase the bearing pressure on the rod.

THE LUNKENHEIMER Co. exhibited its full line of the Lunkenheimer engineering specialties, including force feed mechanical pumps, the Duro blowoff valve, quick closing water gages, pop safety valves, whistles and oilers, and iron and brass bodied Renewo valves. The exhibit was in charge of W. A. Reynolds and A. S. Phillips.

MCLEOD & HENRY'S Steel Mixture, its durable properties and its convenience, were demonstrated by T. L. Morgan and John H. Foote, who showed the different shapes of Steel Mixture brick and also the method of forming these into arches.

GARLOCK PACKING Co. invited engineers to "dig down to the facts" in regard to its No. 900 fibrous and 22 sheet packings, as well as the other styles shown in the showcase. L. W. Weeks and F. S. Mosher were the representatives.

L. L. RICE was present in the interests of National Engineer.

THE REGULAR LINE OF Greene, Tweed & Co.'s packings, including the Manhattan for hydraulic machinery, and Palmetto for steam machinery, as well as the Favorite reversible ratchet wrench, were exhibited by the company's representative, B. M. Bulkley.

A NOVELTY at the convention was the homing pigeons found in the booth of W. B. McVicker Co., in charge of John J. McDonald. These pigeons were the property of Mr. Downey, engineer of the Bel Nord apartments in New York City, and have made numerous records for flights and for long distance work, some of them having flown over 500 miles without stopping, and others having flown at a rate of more than 60 miles an hour. The McVicker Co. demonstrated its method of preparing scientific boiler compounds by analysis of the water to be treated, and also exhibited oils and elevator emulsions for lubricating the plungers of hydraulic elevators.

STRONG, CARLISLE & HAMMOND Co. had a working exhibit of the Strong engine stop, showing the method of operation and the security which it gives from overspeeding the engine. The other Strong specialties, including the working parts of the Strong trap, a model of the trap and of the Strong pump governor, were also shown by the representatives, A. B. Pinney and C. L. Strong.

THE ALBANY CHAMBER OF COMMERCE presented visitors with a pamphlet, giving views of the residence and business portions of the city, and also provided an information bureau for the convenience of strangers.

KEYSTONE LUBRICATING Co., represented by A. D. Page, New York state agent, and J. M. Potts, of New York City, showed blue prints of the tests made at Cornell University on different lubricants in which the Keystone made extremely good records, and also had an exhibit of boxes and cans of the Keystone Grease and of the cups used for applying it.

THE ALBANY BELTING & SUPPLY Co. handled a large number of steam specialties, including the Coes wrenches, U. S. automatic injector, Crescent belt fasteners, Mohawk belt dressing, Forbes dies and die stocks, American injectors, the Phillips pressed steel pulley, leather belting, carborundum grinder wheels and Webco unions. Representative in charge of this display was H. M. Sager.

BIRD-ARCHER Co. had a booth, but made no display.

FOR THE NEW YORK BELTING & PACKING Co. Chas A. Wilhoft, manager, F. E. Friedlander and A. C. Reed presented lines of packing, including the Ruby Red and Indestructible Gray sheet packings, Magic expansion, Cobbs diagonal and spiral high-pressure piston and valve rod packing, and Turxo asbestos twist.

J. L. QUIMBY & Co. showed cards advertising the Valvic lubricating oils.

FOR THE PEERLESS RUBBER MFG. Co., C. F. Heitzmann and H. L. Brown, Jr., arranged a roll of the Rainbow packing with the Big Red Bow and samples of the Honest John braided, spiral waterproof packing, Peerless belting and mats, and the Peerless spiral packing with Rainbow core.

ASHTON VALVE Co., represented by Chas. W. Houghton, displayed an inspector's gage testing set, the Ashton pop safety valves, Ashton steam engine indicators, a line of recording indicating and alarm gages with single and double springs.

GEO. H. THACHER & Co. demonstrated, by means of a full-sized grate, the merits of the new Albany shaking grate with replaceable sections. Separate parts of the different types of bars used were also shown. This model is made with side rocking bars, which tip both ways from the center, or with dumping bars which do not shake but which will dump the fire into the ashpit when desired. Both types are made with removable sections, which can be replaced independent of the rocking bar. G. A. LaVie and T. F. Hogan were the representatives and called attention also to the new screw feed inclined grate stoker which the company is putting on the market.

THE DEARBORN DRUG & CHEMICAL WORKS had its booth decorated with gladiolas and peonies, in which Jos. N. Gregory and J. W. Mitchell welcomed old friends and new acquaintances.

W. M. SWARTHOUT & Co. are agents in Albany and vicinity for a selected line of power plant specialties, all of which are guaranteed for a year, among these the Sells roller bearings, Roto tube cleaners, Wickes boilers and feed-water heaters, Burnham pumps and air compressors, Swartwout separators, exhaust heads, automatic gage glasses, ventilators and other specialties, Simplex blowoff valves and pipe and point clamps. Wm. Swarthout and E. P. Pitts were in charge of the booth, where calling cards were prepared gratis for all delegates.

HOLMES METALLIC PACKING Co. had a booth which was not occupied by an exhibit.

THE FAIRBANKS Co., of Albany, N. Y., made an attractive display of Dart unions in pyramid form, of Vulcan wrenches, Beaver die stocks and dies, Durabla gage glasses and a full line of globe and gate valves. The representatives were Edmund W. Doyle, N. Lansing De Long, D. L. Beattie and A. G. Gray.

BALL ENGINE Co., of Erie, represented by Lyman T. Whitehead, had a working model of the positive valve gear for the Ball 4-valve engine and views of plants equipped with Ball engines. Mr. Whitehead is the representative of the company for the Syracuse territory.

CRANDALL PACKING Co. was on hand "a little singed but still in the game." This referred to the recent fire at the company's plant, which did not, however, delay 24 hr. in shipment of the different packings. Those shown at the exhibit consisted of Helios high pressure, asbestos gasket, sheet and folded stock and the Lip hydraulic, in charge of O. W. Trumbull and H. L. Gates.

NEEMES SHEAR CUTTING and shaking grate was displayed by Neemes Bros., who had a full-sized grate frame equipped with several different styles of bars, some of them adapted for shear cutting as in heating plants where small coal is used, others for shaking and dumping where a heavy fire must be carried and clinker is likely to be formed. The special feature of these grates is the lock box on the end of the bars, so arranged that the bars cannot lift. The representatives were Spencer Neemes and Spencer Neemes, Jr..

W. H. IRWIN was in charge of the exhibit of the Otis Elevator Co., which consisted of a complete control board for elevators connected to a car controller, showing just the method that the control panel operates as the car controller is worked. Another prominent feature of display was Otis lubricants for gears and elevator plungers and boards showing the different parts of the controller. Elevator rope compound and the Eggler guide lubricator were also displayed.

MOREHEAD MFG. Co.'s traps of the new condenser type were exhibited by Ross & Taggart, J. G. G. Ross being the demonstrator. The range of traps displayed went from a capacity of 10 lb. an hour up to 12,000 lb. an hour, and the traps are made in sizes up to 15,000 lb. In these traps the steam is condensed by means of a water spray so that a vacuum even up to 26 in. may be maintained in the body of the trap, thus relieving back pressure on the engine.

WISCONSIN STATE CONVENTION

MILWAUKEE, JUNE 8-11

AS a convention city Milwaukee still holds first place, is the verdict of the engineers of Wisconsin and the supplymen of the central states at the close of the Eleventh Annual Convention of the Wisconsin State Association of the N. A. S. E. The Plankinton House was made headquarters for both engineers and exhibitors, and all business meetings and the exhibits were held in this hotel, in commodious rooms on the parlor floor.

The convention was opened Thursday evening by an informal reception to delegates and guests at the headquarters, the reception being in charge of John A. Wickert of the local reception committee. During the evening a lecture was delivered by H. J. Mistele, on the "Use and Abuse of the Indicator." Mr. Mistele's address was from the standpoint of a man who had years of experience in the practical use of an indicator, and his directions for using and taking care of the instrument and reducing gears will be of considerable value to all those who were fortunate enough to hear the lecture and have occasion to use an indicator.

The informal opening exercises of the convention took place Friday morning at 9 o'clock, when an introductory address was given by H. J. Mistele, chairman of the local committee. Following these remarks, the chairman introduced Mayor Emil Seidle of Milwaukee, who extended the hospitality of the city to the engineers and their friends. In his address Mr. Seidle stated that his city was the first to recognize in public the men who can do things in a workmanlike manner, and he pointed out that engineers who are capable of doing things with their hands as well as with their brains should recognize that earning bread and butter is not their only duty to society.

Response to the mayor's address of welcome was given by State President A. A. Schroeder of LaCrosse, who thanked the mayor and citizens of Milwaukee for their hearty welcome to the city.

National Secretary Fred W. Raven of Chicago was then introduced, and spoke in a general way of the history of the N. A. S. E., what it had accomplished and what could be expected of the association in the future.

Speaking for the Central States Exhibitors' Association, E. P. Gould, the secretary, outlined the plan which has been adopted by the exhibitors of the central states, and on behalf of the association expressed the hope that it would meet with the approval of the engineers of Wisconsin as it has in other states where the association has exhibited.

R. D. Tomlinson, of the Allis-Chalmers Co., who is a past national president of the N. A. S. E., spoke of the benefits he had received from his membership in the association, and recalled a number of instances where the most difficult engineering problems had been solved by the stationary engineers in his own plant.

Formal opening of the convention was then announced by President A. A. Schroeder, who in his address outlined what he had endeavored to do during his term of office, and how this work could be carried on during the coming year. Following his address the appointment of committees was made, and the meeting adjourned to allow the committees time to draw up their reports.

The afternoon session was short, consisting of a lecture by Sam Furst of LaCrosse, on illumination. Mr. Furst pointed out the advantages of using metallic filament lamps in preference to other incandescent types, and the economy of using shades and reflectors for specific illumination.

Following the lecture was a short business session, and the meeting adjourned to allow the engineers and supplymen to visit the plants of the Richardson-Phenix Co. as the guests of Mr. Richardson, who chartered private cars for transporting the visitors to and from the factory, where the manufacture of Richardson Force Feed Oil Pumps was studied.

In the evening an informal ball and luncheon was served in good old Milwaukee style.

Heat and Ventilation

SATURDAY morning's session was opened by a lecture on "Heat and Ventilation," given by B. J. Miller of Milwaukee, who spoke of the composition of average air, explaining the effect of each gas, those which support life, those which dilute, and those which are poisonous to the human system. The need of artificial mechanical ventilation is made evident by the death rate statistics, which show that during the vacation of schools, the death rate of school children is reduced 300 per cent. In hospitals the death rate has been reduced from 45 to 5 per cent by the use of mechanical ventilation, and in stables the death rate of horses is reduced from 19.3 to 1.3 per cent.

After showing the need of mechanical ventilation, Mr. Miller took up the points which determine the capacity of fans and heaters necessary to supply a building. He stated that 50 cu. ft. of air per minute is required for each adult person, and that the air should be changed 6 or 7 times an hour in a public building. He then took up the rating of furnaces, boilers, etc., required to heat the building to the proper temperature, and pointed out the necessity of washing the air and keeping the humidity correct. It is stated that a maximum of 70 per cent humidity or 140 grains per cu. ft. at 70 deg. should never be exceeded. The minimum for human beings is 30 per cent, but the average and most comfortable humidity is 50, which is that most usually maintained.

Mr. Miller bases his calculations of capacity upon the rule that 55 B. t. u. are required to raise 1 cu. ft. of air 1 deg. F. He stated, however, that the arrangement of coils through which the air is driven has much to do with the efficiency of the heating apparatus. Attention was called to the erroneous impression that the carbon dioxide which escapes from the lungs, being heavier than air, will immediately sink to the floor. This, however, is not the case, as the gas which leaves the lungs is heated to a temperature of 98 deg., and at this temperature is almost the same weight as the air itself. For this reason it is necessary to maintain a current of air throughout the entire room, and the velocity recommended for schools is 3 to 4 ft. per second, which cannot be perceived without artificial means. In shops and factories this may be increased somewhat, depending upon the nature of the atmosphere about the workmen.

There are 2 types of fans which are in common use in artificial ventilation, these being the exhauster and the blower. For heating purposes the blower fans are the most common, for the reason that the air which it handles can all be treated before it enters the room, while in the case of the exhauster, the pressure of the air within the room is reduced, and air will enter at any point where there is an opening to the outside atmosphere.

Speaking of the most desirable humidity, Mr. Miller stated that he had seen cases where the humidity was raised in order to reduce the static electricity, such as in cotton mills where the lint attaches itself to a belt charged with electricity. In other cases the humidity may be lowered, as in drying kilns for lumber, to such a

point that it is injurious to human beings. The law in some states compels those who operate factories where people are employed to maintain a standard humidity.

John W. Lane was then introduced, and gave an address on "Education, and the Relation of the National Engineer to the Members of the Association."

Closing Business Sessions

DURING the business session which followed, the matter of a state license was taken up, and a committee appointed to draw up a suitable license law and confer with the state legislature in regard to its passage.

The following officers were then elected for the ensuing year: William Classman, Milwaukee, president; H. M. Holst, LaCrosse, vice president; Robert Fenn, Sheboygan, secretary; J. W. Murphy, Madison, treasurer; Geo. W. Briedock, Stevens Point, conductor; Dan Dreger, Manitowoc, doorkeeper; Martin O'Connor, Milwaukee, state deputy.

Installation of the newly elected officers was then conducted by National Secretary Raven, assisted by Past National President Columbus Dill.

At the afternoon session, E. P. Gould, of the Lunkenheimer Co., read a paper on the "Nonreturn Stop Valve," bringing out its importance in the power plant, the conditions under which it is compelled to work, and the designs which have proved most successful for performing the duty required of the valve.

During the remainder of the afternoon, those in attendance were taken in chartered cars to the Pabst Brewing Co.'s brewery, and also to that of Joseph Schlitz Brewing Co. At both of these places the guests were taken through the bottling rooms and the power plant and finally treated to the famous products of Milwaukee.

Convention Pleasantries

SATURDAY evening a smoker was tendered by the exhibitors to the officers, delegates and guests of the convention, at which Robert Hills introduced the toastmaster, Mr. Tomlinson, who kept the evening enlivened by his wit, and introduced as interesting speakers engineers of state and national reputation until a late hour. A great share of the success of the evening was due to the Exhibitors Quartet, which rendered songs prepared especially for the occasion.

The ball game between the exhibitors and engineers of the state resulted in a score of 11 to 3 in favor of the engineers, who were tendered a trophy in the form of a punch bowl.

Sunday afternoon a boat ride on Lake Michigan was enjoyed by the visitors and engineers of Milwaukee on Pere Marquette steamers.

A trip to Ravenna Park as the guests of the management of the resort was tendered to the attendants at the convention Sunday evening and all returned to their homes shouting praises of Milwaukee as a convention city.

Exhibitors Notes.

THE Central States Exhibitors' Association, which was formed at the convention in Oshkosh last year, did excellent work in the management and decoration of the exhibits, which were displayed in the Colonial Room of the Plankinton Hotel. There were 38 booths in the hall, occupied by different concerns, the decorations being furnished by the Exhibitors' Association in the color scheme of red and white, which are the colors of the University of Wisconsin.

SWIFT FUEL CO., of Chicago, showed the operation of one of its stokers with a capacity of 80 to 200 hp., mounted upon a boiler front. H. W. Carpenter was the demonstrator and distributor of literature.

NATIONAL ENGINEER was represented by its editor, John Lane.

MECHANICAL APPLIANCE CO., of Milwaukee, manufacturer of electric machinery, exhibited small a. c. and d. c. motors, ventilating and blowing fans, motor driven. T. R. Douglas was on hand to speak the good points of the machinery.

CHASE BROS. CO., of Milwaukee, exhibited Martin grates, Erie stokers, Vacuum traps made by C. A. Dunham Co., Wilcox gaskets and metallic packing. C. L. Chase was in charge, assisted by F. P. Bird and J. M. Robb.

GARLOCK PACKING CO., of Chicago, was represented by John Terrill and J. R. Gish, who lost no time in explaining the advantages of the full line of sheet, gasket and ring packing, manufactured by their company.

ENGINEERS AND FRIENDS WHO ATTENDED THE WISCONSIN CONVENTION

THE STEAM APPLIANCE CO., of Milwaukee, showed Victor steam and oil separators, Peters Improved Corliss valve traps and the Henry steam flue cleaner. The company was represented by L. A. Peters.

PERFECTION HEATER & PURIFIER CO., of Chicago, showed the excellent points of its apparatus by blueprints and literature on feed-water heaters and purifiers, the representative of the company being A. Forsythe.

AMERICAN-THOMPSON IMPROVED INDICATORS, American Ideal reducing wheels, American special pump safety valves, gage testers, recording gages, draft gages, etc, all manufactured by the American Gauge & Valve Mfg. Co., were in charge of Chas. C. Kilander.

LYONS BOILER WORKS demonstrated the excellent steaming qualities of Lyons boilers, by the use of a model which was in charge of William P. Lyons.

CRANDALL PACKING CO. displayed a full line of fibrous and metallic packings, the booth being in charge of Fred Brunner.

THE RICHARDSON-PHENIX CO., of Milwaukee, exhibited lubricating specialties, consisting of sight feed oil pumps, mechanical oil pumps, individual filtering systems, sight feed gravity and pressure oiling systems, and a combined filter and reservoir. The company was represented by W. E. Richardson and G. E. Peterson.

H. W. JOHNS-MANVILLE CO. had a full line of sheet and ring packing, insulating material for heat, refrigeration and electricity, and fire extinguishers on exhibit. The good qualities of these products were put forth by A. E. Welch and A. C. Gute.

J. ANDRAE & SONS CO., of Milwaukee, who deal in electrical supplies, exhibited Hubbell lamp guards, Bryan-Marsh Gem lamps, Westinghouse fans, Wagner a. c. motors and American electric flatirons. E. Thoms was the representative at the booth.

MILWAUKEE FACTORY SUPPLIES displayed White Star oil filters, Clean Seat valves, U. S. injectors, Pittsburg Gauge & Supply Co.'s recording gages, pipe wrenches, roller bearings, etc. M. P. Janisch was in charge of the booth.

HOYER METALLIC PACKING CO., of Milwaukee, manufacturer of metallic piston rod packing, metallic valve stem packing, governor automatic safety stops and telescopic oilers, showed all

of these in full and cross section in its booth. Those in charge were J. Beckley and Wm. T. Duke.

THE WM. POWELL CO. took up the space in its booth to advantage with White Star valves, Trojan cylinder lubricators, Middy lubricators, compression grease cups, injectors, lever throttle valves, etc. M. F. Brenner had charge of the booth.

PHIL GROSS CO., of Milwaukee, dealer in engineering tools, displayed oilers, lubricators, injectors, hack saws, belt hooks, Daniels P.P.P. packing, machinists' tools, etc. J. C. Sim and G. P. Suess were the attendants at the booth.

PRACTICAL ENGINEER was represented by R. E. Turner.

THE LUNKENHEIMER CO. displayed Renewo valves, safety valves, oiling devices, cast-iron and brass globe, gate and angle valves, check valves, gage cocks, etc., the booth being presided over by E. P. Gould, assisted by C. C. Rodenberg, who not only explained their products, but distributed flowers to the ladies and souvenirs to the gentlemen.

WADHAMS OIL CO., Milwaukee, exhibited Badger lubricants, Pennsylvania lubricating oils, and oil testing instruments. G. C. Sullivan and G. W. Hale represented the company.

THE WICKES BOILER CO. demonstrated the excellent circulating qualities of the Wickes boiler, by means of a model made with a glass shell. J. Milne and C. S. Wilson were attendants at the booth.

HILLS-MCCANNA CO. exhibited a line of force feed lubricators, pumps of various sizes and connections, Robert E. Hills having charge of the booth.

MICHIGAN LUBRICATOR CO. had a design made up of nickle plated oil cups, lubricators, force feed grease cups, etc; also a Williams gage showing the best methods of connecting these appliances to the steam and oiling systems. H. P. Spaulding is the local agent and had charge of the booth.

JENKINS BROS. displayed the Jenkins Diamond brand globe, angle, check and Y valves, '96 sheet packing, safety glass holders, and other specialties. Joseph H. Williams was the representative.

PALMETTO AND MANHATTAN packings made by Greene, Tweed & Co. were displayed by Geo. A. Hawkins, who had charge of the booth.

ALLIS-CHALMERS CO. exhibited an induction motor and a motor starter in its booth, and distributed literature in regard to power plant apparatus. R. D. Tomlinson represented the company.

G. M. DAVIS REGULATOR CO. was represented by M. D. Neely, who showed the excellent points in construction of the Davis regulator, traps and steam specialties.

DEARBORN DRUG & CHEMICAL WORKS took up the space in its booth with fresh cut flowers which were distributed to the ladies while literature on boiler feed water treatment and high grade lubricants was given to the men at the convention. E. T. Ward, J. E. Foster and J. W. Harkins were the attendants at the booth.

THE V. D. ANDERSON CO., manufacturers of Anderson traps and oil filters, displayed cross-sections and parts of these pieces of apparatus. The booth was looked after by I. P. Lounsbury and B. Lounsbury.

THE VILTER MANUFACTURING CO. displayed steam pipe specialties, dash pots, lead gaskets, refrigeration appliances, etc., and gave away literature on engines and refrigeration. L. O. Trubshaw and A. L. Rosmann were the demonstrators.

THE SCOTT VALVE CO. and the American Steam Pump Co. occupied one booth in which were displayed pumps, Hill pump valves, gate and globe valves, etc. Those having charge were H. A. Baker and W. T. Birch.

KEYSTONE LUBRICATING CO. had a full line of grease and grease cups on exhibition, and A. S. Bennett presided.

PEERLESS RUBBER MFG. CO., represented by its western agents, Geo. B. Carpenter Co., of Chicago, displayed Peerless packing, Rainbow belting, sheet packing, rubber hose, gage glass rings and other specialties. C. W. Reedy, Fred Margraff and F. Von Geyso were attendants at the booth.

OSBORNE HIGH PRESSURE JOINT & VALVE CO. displayed steam, ammonia, gas and hydraulic valves, made of brass and iron. W. L. Osborne, assisted by C. M. Schneider, had charge of the booth.

HAWK-EYE COMPOUND CO. was represented by Theodore Brummenschenkel, R. M. Rochfort, H. E. Tibbles, W. O. Tibbles and George Kuehn.

A WEEK IN QUAKER TOWN

THE SILVER ANNIVERSARY AND ANNUAL CONVENTION OF THE AMERICAN ORDER OF STEAM ENGINEERS

THE fact that it was held in Philadelphia should lead to no hasty conclusion that it was a slow week. On the other hand, every minute was filled with work or recreation, and the halls, both exhibit and convention, were filled with interested visitors.

Monday, the opening day, was taken up, as were most of the other days, with afternoon and evening sessions of the Supreme Council in regard to business affairs, but with always time for a stop to see interesting sights, and to pass a word of good fellowship. The rest time for Monday was devoted to a trip to Wanamaker's store and the evening was given up to a formal opening of the exhibit, held in the main auditorium of the Odd Fellows Temple, and this exhibit was well worth the spending of one evening or five in careful examination.

Tuesday morning was strictly business, though the exhibit hall attracted many delegates, both before and after the business session. In the afternoon the exhibit was closed and all hands went on an excursion down the Delaware on the steamer Thomas Fried, at which the delegates, ladies, visitors and exhibitors relaxed and enjoyed themselves to the utmost. The evening was left open and was spent by practically all engineers, both delegates and visiting members, in the exhibit hall.

Wednesday was the great day. An incident of interest to all members of the order was the presentation by William G. Le Compte, on behalf of Jenkins Bros., of an ivory gavel, silver trimmed, to each subordinate council of the order, and an ivory gavel, gold trimmed, to the supreme council. Mr. Le Compte, on account of his association with the order, and especially of his prominent part in founding the American Supplymen's Association, is known to every visitor to a convention, and is deservedly popular with members and exhibitors. In making the presentation he gave a brief outline of the history of the American Supplymen's Association, and in closing bade formal farewell to the organization, as he does not expect, in future years, to attend the meetings as a representative of his firm.

The Supreme Council expressed, through its spokesman, its appreciation of the magnificent gift, and presented a resolution of thanks to the donors, Jenkins Bros., to their representative, Mr. Le Compte, and to the Supply Men's Association for the work that had been done.

In the evening the grand silver jubilee banquet in Scottish Rite Hall presented a scene of great impressiveness. Over 800 guests were seated in the hall, who were served with a bounteous repast, after which addresses by the Supreme officers, by representatives of the Board of Education, the United States Army, and songs and recitations by members of the New York bunch, kept the large audience busy until a late hour.

Thursday was occupied largely with discussion of the place of meeting for the next year and also with election of the new officers. These resulted in the choice of Allentown as the place for 1912 convention and the officers elected were as follows: Supreme chief engineer, Louis D. Schlehner of Philadelphia;

Supreme assistant engineer, George W. Goodman of Baltimore; Supreme recording engineer, Florian J. Armbruster of Philadelphia; Supreme corresponding engineer, Charles F. Noble of Atlantic City; Supreme treasurer engineer, Thomas J. Donovan of Philadelphia; Supreme senior master mechanic, Thomas M. Montgomery of Camden; Supreme junior master mechanic, Frank S. Miller of Reading; Supreme chaplain, Walter Long of York; Supreme inside sentinel, Richard Sullens of Baltimore; Supreme outside sentinel, William Eccles of Philadelphia; Supreme trustee, William Pairent of Philadelphia.

In the afternoon all hands went on an outing to Washington Park, where athletic games were held—a ball game in which the engineers proved themselves better than the salesmen, and a general good time was enjoyed.

Friday morning was devoted to the installation of the new officers and to the closing business of the convention, including thanks to the local committee, to the banquet committee, to the supplymen, and to all others who had contributed to the success of the convention. The 1911 convention committee, to whom was due great credit to the success of the meeting, were Louis G. Schlehner, chairman; William Pairent, secretary; William Eccles, vice chairman; J. Holland, treasurer, and the following members: Franklin R. Moore, William Harney, Thomas Donovan, Michael Helmstreit, Jr., George W. Richardson, F. J. Armbruster, John W. Hill, Frederick Markoe, Daniel Bunting, William Getz, Joseph Whitley, David Sullivan, Frank H. Lewis, R. B. George, William Beaupean, William Wisner. The committee in charge of the banquet included Charles A. Hopper, Frederick Markoe, William Pairent, Louis G. Schlehner, Charles P. Sanville and Fred L. Jahn.

The Supplymen

ON Tuesday morning a brief meeting was held of the American Supplymen's Association, and reports read and accepted of the work of the committees so far; also a nominating committee appointed, and the meeting then adjourned until Thursday morning. On Thursday the meeting, called to order by President A. R. Foley, received the report of the committee that all bills had been paid, and that there would be a surplus carried over to the next year. Election of officers was then taken up and the report of the nominating committee was read and accepted and the secretary cast a single ballot for the names as presented. The officers elected were: President, Harry Winner of the Garlock Packing Co.; vice president, Frank Martin of Jenkins Bros.; secretary, Fred L. Jahn of the Watson-McDaniel Co., and treasurer, John W. Armour of the Hill Publishing Co.

Mr. Le Compte, past president of the association, presented his formal farewell, as it was his last convention of the American Order, and was tendered a vote of thanks for the work he had done in past years. The report was received from the convention that the next meeting would be held in Allentown, and the opinion was expressed that it would be good policy to go there, and nearly all those present expressed their intention of so doing.

Appointment of the executive committee was then made as follows: C. P. Stein, of the H. W. Johns-Manville Co.; George C. Davis, of Thomas C. Warley; J. F. Boreland, of the A. W. France Packing Co.; S. McCullom, of McCullom & Co.; Albert Schade, of the Albert Schade Valve Manufacturing Co.; Charles E. Hopper, of the Keystone Lubricating Co.; Charles F. Sanville, of McArdle & Cooney; Harry E. Souder, of John R. Livezey; Charles Camp, of the Strong, Carlisle & Hammond Co., and Arthur L. Rice, of Practical Engineer.

During an interval in the meeting a subscription was taken up and was used in the purchase of a handsome loving cup, which was presented to retiring President Foley on Thursday evening.

Features of the Exhibit

THE BACK PRESSURE and release valve, as used in the steam stack and cutout valve heaters made by the Harrison Safety Boiler Works, was the interesting feature at that company's booth. This is provided with springs and dash pot so that there is no jumping of the valve, has a common plate which can easily be taken out for regrinding the valves and has 2 large side openings, giving plenty of working room in adjusting or fixing the valves. To explain its interesting features there were present for the company Messrs. J. R. Hibbs, J. Crowley, F. E. Scott and R. D. Wright.

THE PAUL B. HUYETTE Co. represents a number of meritorious specialties in Philadelphia, besides its own. Full sized Reliance water columns equipped with the Huyette gage cocks, Reliance water regulators and pump governor, and the Huyette quick closing gage cocks were an interesting display. There was also shown the Reliance trap, the separate marine gage fittings in the extra heavy and the regular grades, the Tornado blower in 3 sizes for cleaning tubes, and the Pittsburg Recording Gauge, made by the Pittsburg Gauge & Specialty Co.

Combined with the exhibit of the Huyette Co. was that of the "S-C" Regulator Co., which consisted of a complete power plant and fan drive, the boiler equipped with the regular S-C feed-water regulator and pump governor and with the S-C gage cocks. The company, which was represented by N. C. Copley, also exhibited the full sized water column with gage cocks, regulator and pump governor, the same as installed in a plant. At the other side of the Huyette exhibit was that of W. B. McVicker & Co., chemical engineers and specialists in lubricating oils and boiler compounds. Representatives of the McVicker Co. were W. B. McVicker and G. Frank Duemler, and for the Huyette Co. were Paul B. Huyette and Walter C. Edge.

PISTON ROD PACKING of the special D brand, also the Daniels P.P.P. cushion packing for steam, water, ammonia, oil, air, etc., pump disks and combination hose made up the features of the exhibit of the Quaker City Rubber Co., in charge of H. Rittenhouse, Chas. G. Savage and Geo. W. Schultz.

THE PRINGLE ELECTRIC Co. and the V. V. Fittings Co. presented a combination exhibit consisting of a full sized switchboard panel and distributing panel made on regular order for power house use, also panel boards, outlet boxes and heads with porcelain bushings for use in conduit wiring work. F. Tresselt was in charge of the exhibit.

W.-B. PACKINGS are a new brand introduced by Wise & Bailey and including flax, ring, twist and braided types for all purposes. H. T. Wise and F. H. Brown were the packing experts in charge.

JOS. P. MANYPENNY, of the Engineering Equipment Co., explained the action of the Condit motor switch and circuit breaker for near or distant control of electric motors.

MEASURING PRESSURE, or testing gages which measure pressure, or the measurement of variable pressure in a chamber by means of an indicator might all be performed by instruments which were exhibited by William Wagner and Charles Allen for the American Steam Gauge & Valve Co. Besides the measuring apparatus there was a sectional model of the American pop safety valve and the American relief valve, and display of other brass specialties.

THE SOUTHERN ENGINEER was represented by C. W. Cranmer and J. W. Smith.

PITTSBURG VALVES AND FITTINGS, including gate and globe types, in brass and iron construction, and in all sizes, were shown by F. E. Guntner, salesman for the Pittsburg Valve & Fittings Co. The exhibit was in the name of Whetstone & Co., the Philadelphia agents.

BLACK SQUADRON valve and rod packings in ring and cushion form, Marguerite hydraulic flax packing in square and round forms, and cushion wedge types, were included in the display of the Cancos Mfg. Co. The drawing for a gold watch, which has been a feature of exhibits of this company many times in the past, was presided over by Harry Harmstadt.

REPRESENTING THE Philadelphia Bourse was L. R. Duffield.

THE EXHIBIT FOR THE American Pulley Co. consisted of American steel split pulleys, both large and small sizes, some of them having special cork inserts to give extra gripping power

to belts. These were shown in both crowning and straight faces and with metal bushings to adapt them to different sizes of shafts. Maurice W. Rudderow represented the company.

AT THE BOOTH OF THE American Order, which was maintained for the convenience of delegates, the wireless telegraph outfit attracted much attention and aroused everyone who received a message. We suspect that the Dearborn Drug & Chemical Works had some part in supplying the elixir, as the activity around the booth strongly resembled that usually found in a Dearborn exhibit.

GREENE, TWEED & Co. exhibited its line of Palmetto packings for high and low-pressure steam, Manhattan packings for hydraulic lines, twist packing for valve stems, and the Favorite Reversible Ratchet Wrench, the exhibit being in charge of B. M. Bulkley.

A NOVEL FORM OF steam trap was shown by the Sarco Fuel Saving & Engineering Co. In this the controlling factor is a corrugated copper tube filled with a volatile liquid. As the stream strikes this tube, the liquid is evaporated and forces the tube to elongate, thus throwing the valve against its seat. With the influx of water the liquid is condensed, the spring contracts and the valve opens. There was also shown Sarco packings in braided, fibrous and gasket form and flax packings both plain and graphited. H. D. Lanbeck and John Brotherton were the representatives.

TAURIL PACKINGS and the Anchor Packing Co. are always associated. The Tauril gaskets and fibrous sheet were accompanied by cushion and metallic covered packings in spirals and coils and by asbestos molded gaskets. Representatives were L. E. Adams, W. R. Haggart, Richard Swiler, B. J. Miller, M. Fleming, D. T. Helmer, W. H. Green and Charles Barnes.

GRATE BARS OF ALL TYPES are manufactured by the Frick Grate Bar Co., which exhibited some samples as well as a Long duplex shaking grate. They exhibited also a boiler control apparatus for automatic control of the combustion, as manufactured by the Turbo Blower Co. Representatives of the Grate Bar Co. were C. V. Frick, Horace E. Frick, J. P. Whitley and Geo. C. G. Gray.

H. B. UNDERWOOD & Co.'s apparatus for making engine room repairs, including the crankpin turning machine and cylinder boring apparatus, attracted much attention, as always. In addition there was the St. John steam piston packing and the special dashpot for Corliss engines, all exhibited by Harry Yeager and Hiram D. Griffith.

E. F. HOUGHTON & Co. specialize on lubricants and greases, Vim leather packings and Marck steam trap, and all these were adequately shown in the exhibit, which was in charge of Franklin Moore, Walter Redding, Chas. E. Pearson and Matthew Anderson. The Marck trap operates on the expansion of a liquid which closes the valve when steam strikes the containing tube and opens it when water reaches the tube, the action being automatic and instantaneous.

NONPAREIL CORK INSULATION for refrigeration plants, cork pipe coverings and insulation for cold storage rooms, made up the exhibit of John R. Livezey, which was in charge of Mr. Livezey and Harry E. Souder.

EVERYBODY WANTED Keystone Grease; at any rate, Chas. E. Hopper, who was in charge of the exhibit of the Keystone Lubricating Co., had a deal of trouble in keeping his exhibit together. It consisted of different grades of the Keystone Grease and different forms of grease cups. In fact, the whole grease cup family was shown, but they frequently strayed to the booths of other exhibitors. Besides Mr. Hopper, Warren F. Buzby and Thomas O. Organ were present.

THE SCHADE BALANCED float valve for regulating the height of water in tanks was the special exhibit of the Schade Valve Mfg. Co. The company is also agent for the G. M. Davis Regulator Co. specialties and exhibited the Davis regulating valves, traps and pressure valves, as well as the Schade pump regulator. Representatives were Albert Schade, L. M. Lewis and O. B. Lewis.

CRANDALL PACKING Co. exhibited its entire line, in charge of Harry Crowder and including gage glass rings, braided packings and special Lip hydraulic packing for rods and plungers.

R. G. VON KOKERITZ & Co. presented an attractive exhibit of its Durabla products, including sheet packing, cut gaskets for all kinds of flanges and the Durabla glasses for water gages and sight feeds with fused ends. Jack Carson explained the durability from which these products derive their name.

ASHTON VALVE Co. showed a line of safetv valves specially built for superheated steam, recording gages, test gages, relief valves, gage testers and other specialties in charge of Chas. Leo Buckman.

HEAVY VALVES were notable in the booth of the Nelson Valve Co. These included extra heavy globe valves with rising stem and a bypass, features not ordinarily found in this type of valve, the bonnets being extra long to permit of packing the valves when under steam. A line of standard, heavy and extra heavy brass body valves was also shown, the bonnet being outside the body of the valve, the gate valves being of the double disk type, self-adjusting to the seats. Superheat valves made by this company have specially heavy steel bodies and Monel metal stems and rings. The sections of the disks were shown with the inserted ring, also samples of the metal after undergoing test. Carlisle Mason, W. J. Spencer and R. E. Thomas were at the booth to welcome friends.

MCARDLE & COONEY handle a large line of steam specialties, including those of the D. T. Williams Valve Co., the Williams valves and grease cups, Bard unions with inserted brass seats, the Trimo tools and chain wrenches, the Wright exhaust heads and Emergency and Victor steam traps and Emergency boiler tube plug. Chas. P. Sanville and James White were representatives.

OILS AND BELT DRESSINGS, including the Royal brand for engine cylinders, bearings, dynamos, the Detroit greases for bearings, waterproof belt dressing and the Royal boiler compound were the products shown by the O. F. Zurn Co. Its representatives were J. M. Zurn, Chas. J. Curran, J. D. Kelley, J. L. Wilson, H. B. McKinley, Wm. H. Henszey, Chas. J. Curran, Jr., and Henry F. Zurn.

FOR THE WILKIRK ELECTRIC Co. Harry L. Mondorf presented a display of different sizes of the Bryan-Marsh lamp with tantalum, tungsten and carbon filaments.

THE POPULAR ENGINEER was represented by Wilson Van Buren.

GEO. W. LORD Co. distributed through its representatives, Capt. J. E. Doughty, C. N. Phillips and C. A. Hayes, the popular book on Boilers and Their Treatment.

GARLOCK PACKINGS were the twist, round and square types in combination braided and cushion form, also pump disks and spiral packings. Garlock representatives were C. F. Flood, Hugh Edwards, J. Gordon, H. W. Guliger, T. Goulcher and H. N. Winner.

CYRUS BORGNER'S display of fire brick of all kinds in regular and special shapes, and fire brick construction for front arches, baffles and tube covers, was in charge of Geo. H. Dickel, Jr.

C. H. CAMP, F. S. PALMER and Homer Whelpley exhibited for the Strong, Carlisle & Hammond Co. its entire line of Strong steam specialties, including the engine stop and parts, the pump governor, the trap and the relief valve.

THE PEERLESS RUBBER MFG. Co. presented the usual line of Peerless products, including spirals in round and square form, tubular gaskets, steam, hydraulic and suction hose, and Rainbow sheet packing, including the roll with the big red bow. The representatives were C. F. Heitzmann, of New York, and Len S. Hillman, of Philadelphia.

WM. C. ROBINSON & SON Co. had a fine display of crude, refined and combined oils and of light and heavy greases for all purposes, giving a comprehensive idea of the products of this company. Representatives were F. W. Robinson, V. E. Kummerer, J. E. Miller, T. D. Star and S. W. Russell.

TRILL INDICATORS and reducing wheels, especially the new type of continuous card indicator, were attractively displayed by W. L. Trill and L. T. McElroy in the booth of the Trill Indicator Co.

POWER HOUSE, of Canada, was represented by Mr. Heustis.

JONES UNDER-FEED STOKERS and what they have accomplished were explained by the Under-Feed Stoker Co. of America, which distributed copies of the Publicity Magazine and of pamphlets showing how to get Better Power and describing installations of Jones stokers. The representatives were C. S. Crowell and W. S. Crowell.

E. J. ROOKSBY Co., represented by Mr. Rooksby and C. F. Odell, exhibited its cylinder boring machines, the Dill rod hook for Corliss wristplates, crankpin boring machines and other engine repair specialties.

SAMPLES OF TESTS made on the material from which Parkesburg charcoal iron boiler tubes are made were convincing evidence of the quality of these tubes. Some were mashed flat, others bent double, other pieces of material tied in a knot, without sign of fracture. Photographs of the Parkesburg Iron Co.'s plant gave evidence of the ability of this firm to do large and effective work. The representatives present were C. L. Humpton and W. H. S. Bateman, of Philadelphia, John H. Smyth and H. C. Hunter.

A. B. BOTFIELD & Co. displayed Adamant fire brick cement, which is a plastic material to be formed into shape as needed, also shapes were shown made from this cement, illustrating how furnace linings can be constructed without a joint. Special shapes made from the material were also exhibited. The representatives were A. B. Botfield and C. C. Phillips.

VACUUM OIL Co. presented brands of oil, including the Gargoyle cylinder oil, Arctic vacuum and Etna engine oils, and a special grease for transmission gears. Jos. L. Scott, of the technical department, and A. Hovey-King were the representatives.

THE EVERLASTING BLOWOFF VALVE, as made by Scully Steel & Iron Co., was exhibited by Elisha Webb & Co., agents for the Philadelphia territory. The representatives were Elisha Webb, Jr., and T. C. Smith. At this booth was also literature describing the Cabe & Knapp boiler feed-water regulator.

MCCULLOM & Co., agents for R. & J. Dick, Ltd., exhibited the Dick Balata belting, Jackson belt fasteners and samples of Balata belts of all sizes. A large model was shown illustrating the action of a belt driven through water which ran continuously during the exhibit without sign of being affected. S. McCullom and H. L. Meyers were in charge of the booth.

WHITE STAR VALVES and valve specialties, oil and grease cups, cylinder lubricators and the Powell union disk valve were shown by C. J. Rainier and Chas. F. Bloom, representatives for the Wm. Powell Co.

KEWANEE UNIONS, the "union with no inserted parts," in flange and screwed types, also arranged as part of valves and fittings, were shown in the display of the National Tube Co. This was made brilliant with the Kewanee pennants which set forth strikingly the construction of the union. The representatives were R. T. Browne, Jr., and J. E. Fleming.

STANDARD BRASS and iron valves and a pyramid of Dart unions of all sizes, these having bronze seats, giving a bronze to bronze connection, were displayed by the Fairbanks Co., whose representatives were H. H. Freund, Jr., W. DeHaven and M. V. Cordell.

BIRD-ARCHER boiler compounds and samples of the material from which compound is made, of the compounds used for different kinds of water and of scale taken from boilers, was shown by the Bird-Archer Co., represented by T. H. Desmond. The book Boiler Troubles and Their Prevention proved interesting to many engineers.

MCLEOD & HENRY Co., represented by John H. Foote and Frank Tuthill, displayed the familiar model of a Steel-Mixture boiler setting and miniature Steel-Mixture furnace, and also exemplified the method of cutting the Steel-Mixture brick without loss.

D. K. SWARTWOUT and H. H. Lind exhibited a full line of the Swartwout steam specialties, including the Swartwout exhaust head, Swartwout separator, Swartwout automatic safety water gage and Swartwout ball bearing ventilator made by the Ohio Blower Co.

FRANCE METALLIC PACKINGS for rods and stems, suitable for air, steam or oil machinery, and the France air lift, were the exhibits of the France Packing Co., represented by A. W. France and J. F. Boreland.

MASON RED STAR COAL was shown in different sizes by the Mason Coal Co.

LUBRICATION OF ELEVATOR GUIDES by means of the Imperial lubricator was the lesson taught at the booth of the American Engineering & Mfg. Co. by the representatives, A. F. McIndoe, Geo. B. Smith and Norton J. Bond.

BROGAN & Co. are agents in Philadelphia for the Kieley & Mueller specialties, also for the products of the Michigan Lubricator Co., including lubricators and lubricating specialties, for the Danubil sheet packing identified by the wavy line, for Manzel Bros.' oil pumps and Homestead valves. The representatives were Jas. J. Brogan and Charles Foell.

HUHN METALLIC PACKINGS for rods and valve stems, the packing that lubricates and is known by the famous D. L. brand, also the Huhn flexible packings, were exhibited by the Huhn Metallic Packing Co., in charge of A. C. Judd, manager, and H. A. Hutchinson.

JOHNS-MANVILLE PIPE COVERINGS in asbestos, air cell and magnesia forms, packings for ammonia, steam and hydraulic machinery, for rods and valve stems, molded asbestos gaskets, electric specialties and the Linolite system for showcase and window lighting were displayed at the booth of H. W. Johns-Manville Co., in charge of E. U. Drew, Thomas Stein, D. K. Dixon and George Sycklemore.

THOMAS C. WARLEY'S boiler compounds in dry form and different brands of lubricating oils made by the company were exhibited by Geo. C. Davis and H. B. Smith. A striking feature was the sheet of scale weighing 12¾ lb. taken from a cylindrical boiler, and a chunk of chipped scale weighing 37½ lb., showing the need of the use of compounds and the difficulties which they remove.

FOR H. BELFIELD & Co., manufacturing J. R. G. valves, fittings and specialties, and agents for steam gages and other appliances, the representatives were A. W. Schwartz and E. C. Magens.

C. J. RAINEAR & Co., agents for Smooth-On iron cements made by the Smooth-On Mfg. Co., displayed a full line of these cements, showing all sizes of cans, all numbers of the cements, and explaining how they were applicable for all kinds of repair work on iron and steel. The No-Koros unions with brass to iron seats were also shown. The representatives for Rainear & Co. were C. J. Rainear, Frank Rainear, Archie McAlonen and Harry Fenner, and for Smooth-On Mfg. Co., C. E. Googins.

ELECTRICAL SPECIALTIES were shown in the booth of F. S. Stewart Electric Co., especially tungsten lamps with holophane reflectors of tremendous candlepower. The lamps were Buckeye and the glassware was made by the Holophane Co. A line of Hubbell special electrical fittings, including fuse switches and panel boards, was included in the exhibits. Representatives were J. E. Eldredge, E. H. Boudwin, J. B. Kelley, Frank Walker, H. V. Nyce and G. H. Carnall.

THE BAYER Steam Soot Blower Co. was represented at the convention by J. H. Lakin.

PHILADELPHIA ELECTRIC CONSTRUCTION Co. presented an exhibit of Hirsch primary and storage batteries and of portable battery fans, represented by Walter Dalton.

WATSON & MCDANIEL steam specialties, including the steam trap, pressure regulating valves, hydraulic steam pump governors, reducing valves, etc., were exhibited by the representatives, Fred L. Jahn and John Beck.

ROTO TUBE CLEANERS in operation by compressed air and a full line of heads and bodies for cleaning boiler and condenser tubes, including drill and cleaner heads, as made by the Roto Co., were shown by J. F. Swan.

THE LAGONDA MFG. Co. presented its usual fine line of Lagonda and Weinland specialties, including the Lagonda automatic return valve, the Lagonda Enterprise triple strainer, tube cleaner heads for steam, air and water driving, the boiler tube reseating machine and the Weinland boiler tube cleaners. The representatives were M. M. Sellers and Hart Hill.

WARREN WEBSTER & Co. exhibited the Webster Star Vacuum feed-water heater and purifier, the Webster steam and oil separator, air valves and relief valves for heating systems, in charge of E. K. Webster, John Montgomery and William Bilyeu.

SECTIONS OF NONRETURN stop valves, the Renewo regrinding valve, oiling devices, sight feeds, whistles and other Lunkenheimer specialties and types of valves were exhibited by the Lunkenheimer Co., represented by Lane Thompson, Jos. H. Hewetson and F. L. Schultz.

PHILADELPHIA GREASES and grease cups made by the Philadelphia Grease Mfg. Co., compressed air grease cups, and pamphlets entitled Points on Lubrication were displayed by the representative, Horace A. Smith.

THE HILL PUBLISHING Co. was represented by C. W. Dibble, Jack Armour, S. W. Anness and H. Anness.

FOR JENKINS BROS. a section of a nonreturn automatic stop valve was displayed. Representatives present were Frank Martin, Wm. G. LeCompte, James McHugh, W. S. Corcoran and Samuel Laird.

THE CORBETT SUPPLY Co. was represented by E. A. Corbett and F. E. Thomas.

REPRESENTATIVES OF THE Home Rubber Co. were A. R. Foley and Homer Bainbridge. The president of the company, W. J. G. Stokes, was also a visitor at the convention.

THE DEARBORN DRUG & CHEMICAL WORKS were represented by H. G. McConnaughy, Porter Jones, Harry Faye, and last, but most conspicuous, G. W. (Pinky) Spear.

A NEW VENTILATING DEVICE

NECESSITY for pure air is being more fully and widely recognized every day. There is, therefore, no need for the manufacturers of ventilating devices to "create a demand"; it already exists, and their problem is simply to convince their clientele that they are prepared to meet this demand in a manner calculated to give best results with minimum expense.

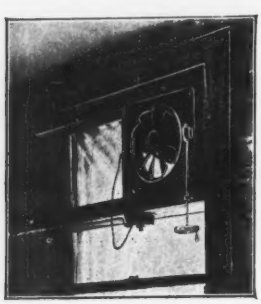
The new and unique ventilating outfit illustrated in Fig. 1 is designed for placing simply and inexpensively into top sashes of windows, transoms or ends of skylights. Outfit includes 12½ in. motor-driven "Ventura" fan, with cast-iron housing, cut worm geared reversing mechanism, rod, bearing and handle, and is furnished complete as illustrated in Fig. 1, ready for connection to plug or ordinary lamp socket.

Fig. 2 illustrates outfit adjusted for supplying fresh outdoor air.

The ingenious reversing mechanism makes it possible to discharge the air straight ahead, upward toward the ceiling, downward toward the floor, or at any intermediate location. Pure, invigorating air introduced

under slight pressure can be supplied without direct draft or directly onto occupants at will.

A simple turn of the hand wheel (Fig. 1) reverses the outfit so that it exhausts from the room, thus providing for absolute ventilation by complete air change. To conserve the lighting effect and add to the appearance, the filler which accommodates the ventilating set can be glazed, as shown in Fig.2.



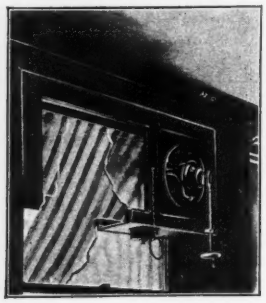


FIG. 1. THE VENTURA SELF CONTAINED VENTILATING UNIT
FIG. 2. VENTURA OUTFIT INSTALLED FOR BLOWING FRESH AIR IN OR DRAWING FOUL AIR OUT

The electrical connection can be made from nearby plug or ordinary lamp socket. Any carpenter or millwright can install the outfit at small cost. This device, known as the "Ventura" Electric Ventilating Set, is being marketed by the American Blower Co., Detroit, Mich., from whom further information can be obtained.

FROM THE FAR EAST

WRITING home from Calcutta, W. C. Redfield sends to the American Blower Co. the following interesting comment on trade conditions as he finds them:

I have now traveled Japan, the Philippines, Hong Kong, Java, the Straits Settlements and Burma to India. This covers the possessions of the United States, Holland, and Great Britain in the East, as well as Japan. I cannot say that thus far I have found any prejudice against American goods.

I have run across horrible neglect in packing, even after attention was called to it. In one case oil stoves were formerly bought in America and the American product was concededly better, but, after warning, the American goods were so badly shipped that half of one shipment arrived broken. Now the dealer buys in Europe and pays a higher price. He told me he did not want to do this but he had to, for American makers would not listen to him.

Bitter complaint is made that American houses trust young irresponsible boys to do their mailing instead of having some clerk of fair responsibility attend to this important service. The result is misaddressed letters so that responses are not received, and the regular habitual neglect to prepay postage causing extra charges.

I do not find prices to be the obstacle. Several American manufacturers I have met tell me their prices are lower than their European competitors. This is true of locomotives, for example. What I find chiefly needed to greatly enhance our export trade in America is knowledge,—knowledge of geography—of the peoples, their ways and needs,—their business methods.

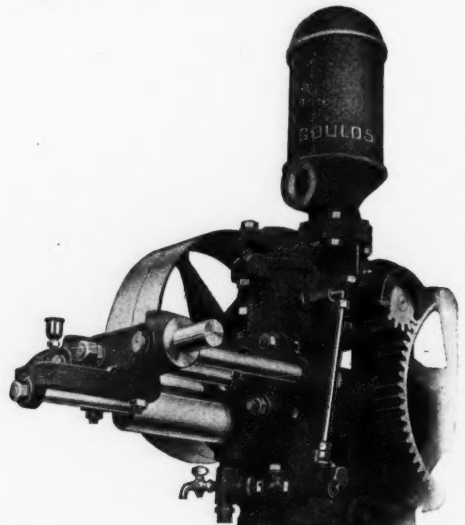
Foreign trade does not essentially differ in its basis from domestic trade. A man selling in Michigan studies Michigan needs, offers goods Michiganders want, tells about them in the way the good people of Michigan understand. If he does not do so the wise ones in Michigan turn him down.

Sometimes houses "peter out" and give up the game too soon to win. Two concerns came from America to India where the prejudice, not so much against American goods as in favor of English goods, is very strong. One after 6 months began to reduce expenses, took a smaller office, then a still smaller one, then closed up. The other lost $20,000 the first year; they had a good man on the spot and held on. The second year they came out even. The third year they got back the $20,000. Then they got it back many times with interest for they had means and courage to stand the gaff.

IMPROVEMENT FOR PNEUMATIC PUMPING SYSTEMS

THE Goulds Manufacturing Co., of Seneca Falls, N. Y., is placing on the market a special air cylinder for attaching to sizes 3 by 5 and 4 by 5 of its Pyramid double-acting piston pump when used for pneumatic water system pumping.

This air cylinder does away with the necessity of a separate pump for maintaining the required air pressure in pneumatic tank systems and is designed to operate against a pressure of 75 lb., which is the maximum rating for the Pyramid. Opening the air cock prevents the air from going into the tank and relieves the pump of all pressure when not required.



GOULD'S PYRAMID PUMP WITH AIR CYLINDER ATTACHED

Suction, discharge valves and cylinder are brass, while the plunger is leather cupped packed and operated by the piston rod of the pump.

The cylinder bracket is rigidly held in place by the same bolts that hold the cylinder head, so that the design and manner of attachment makes this a most compact outfit. The pipe leading from the air attachment is connected to the drain plug opening or discharge chamber of the pump.

Where this attachment is used with the Pyramid

pump for supplying pneumatic tank systems, it is possible to have running water throughout the house, stable or yard for all domestic purposes and for fire protection. The manufacturers will be pleased to forward further information to anyone upon application.

IMPROVEMENTS IN END BELLS FOR ALTERNATING CURRENT GENERATORS

SHEET steel end bells have become a familiar part of the Westinghouse alternating-current generators within the past two years. Their neat and uniform construction gives a generously rounded, complete and distinctive appearance to a machine, not so well accomplished by the more clumsy and heavy castings. Castings, moreover, are liable to be more or less warped and difficult, if not impossible to fit nicely with a reasonable amount of work.

More important than this reason for changing from cast to sheet material was the constant breakage of

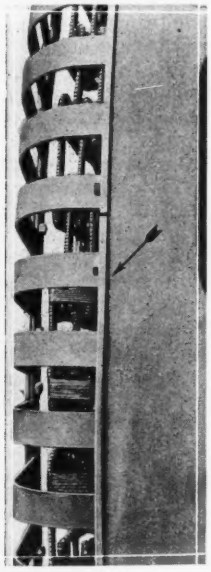


FIG. 1. SECTION OF SHEET STEEL END BELL
FIG. 2. END BELL ATTACHED TO ALTERNATOR

the castings in shipment and erection. The necessary number of different designs made it costly to carry large numbers of cast end bells in stock to avoid delay in manufacture.

Cast end bells, in order to present a pleasing appearance and avoid interference with development, have to be made in shapes rather delicate for the rough handling they receive.

The sheet steel end bell, with its ability to withstand mechanical injury, provided an admirable solution of the breakage difficulty. It is securely bolted to the frame at one end and bound together in a continuous circle on the other end. Sheet steel bells greatly improve the appearance of a machine, because the bells are just alike, the material is smooth and uniform, indicating successful design for a specific purpose.

Fig. 1 shows that the bending strap is angle iron, with one very short flange. In fact it is just long enough to cover the ends of the ribs. Fig. 2 shows how successfully it overcomes accumulation of dirt. This Westinghouse end bell is the most practical and best designed device for its purpose on alternating current generators.

NEWS NOTES

W. M. CHAMBERLAIN has opened an office at 71 Griswold St., Detroit, for the conduct of general promotion departments of manufacturers of machinery, power plant apparatus, mill supplies, etc., and has engaged as chief of his copywriting department Wm. B. Milligan, a writer of experience for magazines and in other capacities. Mr. Chamberlain will act also as advertising counsel for technical journals as to the preparation of copy for their pages.

THE ENGINEERS' BLUE CLUB, of Jersey City, N. J., which is noted for its "strenuous times, famous dinners and good fellowship," will hold its 5th annual outing at Eitner's Midland Park, Grant City, Staten Island, Sunday, July 9. Field games will be arranged and prizes awarded to the winners.

THE KERR TURBINE COMPANY, Wellsville, N. Y., has just been reorganized and $125,000 new capital added. The stock interests of the company are now controlled by F. P. Merrill of Hornell, N. Y., and P. B. Hanks of Wellsville, who, as trustees, have directed the affairs of this company for the past two and a half years. Mr. Kerr is no longer with the company, his position as chief engineer now being filled by Mr. J. L. Moore, formerly a designer with the Westinghouse Electric & Mfg. Co., and later in the engineering department of the Santa Fe Railroad.

The present plant will be materially enlarged and a new machine shop is already in course of erection.

It is the intention of the new company to incorporate into the Kerr Turbine, design changes which are based upon two years' experiments and which will improve the steam economy on all sizes by from 15 to 20 per cent.

THE C. E. SQUIRES CO. is now located in its new building, corner East 40th Street and Kelley Avenue, Cleveland, Ohio, where it is better situated to carry on the increasing business of the company.

IN ORDER TO KEEP pace with the growing demands of its business and to better accommodate its clients, the Iron City Heating Co. has associated with it, Wm. G. Boyle, formerly consultng engineer for the estate of Henry W. Oliver. Mr. Boyle's knowledge and wide experience in steam and electrical engineering and allied branches will be of material benefit to the company.

FORT WAYNE ELECTRIC WORKS was merged on June 1, with the General Electric Co., of Schenectady, N. Y., and will in future conduct the business under the name of Fort Wayne Electric Works of the General Electric Co. The same Fort Wayne and Wood line of apparatus and supplies will be manufactured as in the past and will be sold under the immediate direction of the same individuals with F. S. Hunting in charge as general manager. Correspondence should be sent the same as in the past and bills and statements will be rendered from Fort Wayne, Indiana. All outstanding contracts and other obligations of the Fort Wayne Electric Works will be carried out by the new organization. The same branch offices will be continued as in the past and at the same addresses.

NORMAN MACBETH has been engaged by the Westinghouse Lamp Co., of Bloomfield, N. J., and the Westinghouse Electric & Mfg. Co., of East Pittsburg, to serve their customers in the matter of illuminating engineering. A new illuminating engineering department which will be at the disposal of customers for consultation, plans and

specifications has now been established and will render service in connection with all lighting matters.

ON JUNE 1, 1911, The Sprague Electric Co., was merged with The General Electric Co., of Schenectady, N. Y. Its business will be conducted under the name Sprague Electric Works of General Electric Co.

The manufacture and sale of the lines of apparatus and supplies heretofore exploited by the Sprague Electric Co. will be continued by the Sprague Electric Works of General Electric Co., under the same organization, with D. C. Durland in responsible charge as general manager, and with the assurance that the characteristic high quality of product and efficiency of service to its customers will be maintained.

All correspondence should be sent to the Sprague Electric Works at the same address as in the past. Bills and statements will be rendered from the Sprague Electric works, No. 527 West 34th St., New York, N. Y., to whom all remittances should be made.

The offices of the Sprague Electric Works will be continued as heretofore, with main offices at 527-531 West 34th St., New York, N. Y., and branch offices in principal cities.

ON SATURDAY, June 17, the meeting for the incorporation of the Institute of Operating Engineers was held in the rooms of the Engineering Societies Building, 29 West 39th Street, New York. Some 85 persons were present at this meeting, of which 58 were members.

Hubert E. Collins opened the meetings and J. C. Jurgensen was elected to the chair and H. E. Collins was elected as secretary, after which the letters from those unable to attend were read. L. C. Ferguson explained the legal aspects of the incorporation after which it was voted by the members present to incorporate, and it was also voted that the aims and objects of the Institute be the same as are included under the head of Objects in the pamphlet which has been issued by the Institute.

The meeting was filled with enthusiasm and Mr. Jurgensen recounted the history of the temporary organization, from the first meeting on March 10, 1910, up to the present time, after which speeches were given by Prof. W. D. Ennis of Polytechnic Institute, Brooklyn, N. Y.; A. R. Maujer, Wilson Van Buren, Willis Lawrence, D. B. Heilman, J. G. Ould, T. Healy, and F. L. Johnson.

The roll was then called and the executive committee signed the incorporation papers which makes the Institute of Operating Engineers a legal and duly incorporated institute of learning, empowered to issue certificates and diplomas for the various grades. The institute of Operating Engineers starts out with a charter membership of 326.

The Institute starts with the following Branches formed: New York Branch; Isherwood Branch, of Brooklyn, T. J. Waters Branch, of Chicago; Col. Goethals Branch, of Yazoo, Miss., and branches which have as yet not been named in Providence, R. I., and in Binghamton, N. Y.; in addition to these there are about 18 more in process of formation and waiting the complete incorporation.

The first yearly meeting for the election of officers and the transacting of business, will be held in New York City on Friday, September 1, 1911; the date for successive yearly meetings will be the first Friday of September of each year.

LIKE ALL THINGS which cannot be weighed and measured, advertising is largely a matter of intelligent faith; "an investment in good will and reputation."

BOOKS AND CATALOGS

THE IGNITION HAND BOOK, 73 pages, illustrated, 5 by 7 in., paper covered, price 50c. A copy of this book has been sent us by the Sumter Telephone Mfg. Co., of Sumter, S. Car. The book advocates the use of the magneto for gas engine ignition, and in this it is only in line with the trend of modern progress. That the book is comprehensive and instructive is indicated by some of the chapter headings which are as follows: The Spark and Means for Producing It; High and Low Tension Systems; Ignition Dynamos; and the details of construction of different types of 3-M Magnetos, methods of connection and applications to different engines.

WALWORTH MFG. CO., Boston, Mass., is issuing a handy card for hanging in the engine room, which gives at a glance prices on pipe fittings, valves, blowoff cocks, piping and wrenches of its manufacture.

THE GOULDS MFG. CO., of Seneca Falls, N. Y., has had an experience in the manufacture of pumps extending over half a century and is now putting out a catalog on a new line of single stage centrifugal pumps with side suction, both single and double suction type and adapted for any form of drive. The catalog will be furnished to anyone interested on application.

STRONG, CARLISLE & HAMMOND CO., of Cleveland, Ohio, has just issued a new catalog, No. 14, illustrating its full line of engineering specialties, including traps, pump governors, pressure regulators and engine stops, and will be pleased to mail a copy of this catalog to anyone interested.

BULLETINS FROM THE GENERAL ELECTRIC CO. have been received as follows:

Bulletin 4819 is devoted to the subject of alternating current switchboard panels. The panels described are equipped with oil switches, and are suitable for general use in the central stations and isolated plants. The bulletin contains information including dimensions and connection diagrams regardng 3-phase generator panels, single circuit and double circuit 3-phase feeder panels, generator voltage regulator panels and combination regulator and exciter panels and 3-phase induction motor panels.

Bulletin 4825 illustrates and describes a line of compact, accurate and moderate priced instruments for use on alternate and direct-current switchboards. The bulletin contains dimension diagrams and also illustrations showing the actual size of the meter scales.

Bulletins 4826 and 4827 describe that company's water and air flow meters, respectively. The G. E. water flow meter provides a means of obtaining accurate information which will show the amount of water pumped, consumed, or distributed. The G. E. air flow meter provides a means for obtaining accurate information showing the exact amount of air compressed or distributed. Each bulletin contains a more or less detailed description of the meter to which it refers.

Bulletin 4831 describes briefly a type of oil switch suitable for installing in manholes. These switches are made single, double or triple pole, single throw, and are for use on circuits on voltages up to 7500. The normal current rating is 200 amperes.

BULLETIN 4756, just issued by the General Electric Co., gives a graphic description of the ventilation of horizontal steam turbine alternators, which will be instructive as well as interesting to those connected in any way with the operation of these machines.

THE WESTERN ELECTRIC 1911 Fan Motor bulletin is now ready for distribution. This is listed in the series of publications of that company as bulletin 5352. It is contained within a stiff cover of bluish

gray, with an attractive design, and shows desk and bracket, oscillating, residence, telephone booth, battery, ceiling and column fan motors and ventilating outfits.

BULLETIN No. 1117, describing central battery wall and desk sets, together with their accessories, for meeting standard requirements, has just been issued by the Western Electric Co. This bulletin describes and illustrates central battery telephone sets to meet every condition of service, except where special treatment is needed.

TRADE NOTES

THE BURT MANUFACTURING CO., of Akron, Ohio, has just received another order from the U. S. Steel Corporation for 2 filters of what they term their Gary Unit Type, as this particular type of filter was first installed in the plant of the U. S. Steel Corporation at Gary, Ind. The first order received from these parties called for 5 units, and after 2 months' trial they duplicated the order. Later on they ordered 2 more, and with the 2 just ordered makes a grand total of 14. These filters are used in connection with the flush system of lubrication, and each filter is cleaning 2000 gal. of oil per hour, or 28,000 gal. per hour for the 14, making this oiling system the largest installation in the United States.

The outside shells of these filters are made of No. 10 gage iron, riveted and caulked, and the inside construction of No. 16 gage, making them strong and durable. All fittings are extra heavy, and are screwed into heavy brass flanges. The filters are so constructed that any number can be operated as one, and additional filters attached without changing any connections.

GOULDS MANUFACTURING CO., of Seneca Falls, N. Y., is about to build 4 large additions to the No. 2 plant, in which will be housed the part of the works known as the No. 1 plant, part of which must be torn down to make way for the new barge canal. The new buildings will be parallel with the foundry buildings. A one-story storage building for rough castings is completed. This building is 240 by 60 ft. and of mill construction. Two machine shops, 300 by 100 ft. will parallel the storage building; they will be of steel frame and brick construction and about 70 per cent of the wall surfaces will be glass. South of the 2 machine shops a 4-story warehouse 240 by 60 ft. will be built of reinforced concrete with a loading platform on the south side. The New York Central will build 2 additional switches along the warehouse. All the new buildings will be lighted with tungsten clusters and will be heated and ventilated by the hot blast system, and all equipment of the machine shops will be motor driven. By November 1, the buildings will be ready for use.

STRONG, CARLISLE & HAMMOND CO., of Cleveland, reports that its factory is running full capacity, turning out its modern line of steam specialties to fill as received. Among these specialties is the automatic engine stop for which orders have been taken for 6 to be sent to the Tennessee Coal & Iron Co., for its Alabama plant, 6 to the Philadelphia Rapid Transit Co., a repeat order from the American Writing Co. of Holyoke, Mass., and a stock for the Hardwood Products Co., of Neenah, Wis. All these orders were received within 2 weeks.

DURING THE MONTH OF MAY the Northern Water Softener Co., of Madison, Wis., secured orders for 9 water softeners ranging in capacity from 300 up to 4000 horsepower. The company reports that these were landed after the strongest kind of competition and that it has many bright prospects and a most encouraging business outlook.

CHARLES A. SCHIEREN CO., received the following letter which verifies the company's claim that its belts are waterproof:

"You shipped to Cumana, Venezuela, per S. S. "Munin," sailing November 4, 1908, one Dux-Bak water-proof leather belt, 44½ feet long and 6 inches wide, double.

"On November 11th a fire was discovered in the cargo stowed in the No. 2 hold in which your leather belting had been stowed. Both steam and water were injected into that hold and the vessel put into St. Kitts, where the No. 2 hold was flooded with seawater and the fire extinguished, after which they started to pump the water out.

"After a delay of more than a month at St. Kitts, this vessel returned to New York, arriving there on December 28th, and discharged all of her cargo that had not been thrown overboard as worthless.

"Your leather belting was discharged from No. 2 hold, damp and mouldy, and still in the original packing, which had not been disturbed.

"I examined this belting shortly after it had been taken out of the vessel, and again at your works after it had been cleaned and dried by you, and although it had lain submerged in salt water for about thirty-six hours, and after that had been dried by natural evaporation only, I found that for transmission purposes it was apparently perfectly good in every particular, as none of the seams had opened, and apparently the only damage was discoloration. Albert R. Lee."

REFERRING TO MARION FLUE BLOWERS installed in the Marion Malleable Iron Works plant, J. C. Haswell, vice president, writes as follows to the Marion Machine, Foundry & Supply Co., which manufactures the blowers:

"Referring to our conversation of yesterday with your reference to test of your Flue Blower. Would say that we purchased this on a guarantee that it would save 10 per cent of our fuel. We did not install the blower until January first, and in order to determine its efficiency, we kept a record of our coal consumption in December, January, and February, and we are pleased to hand you the figures herewith: December without blower, 206,700 lb. coal; 287 lb. per hour. January with blower, 182,700 lb. coal; 254 lb. per hour. This test was run under as nearly uniform weather conditions as it was possible to secure and on this showing the flue blower more than made good and we are pleased to send you our check for it.

"In February our coal consumption amounted to 233 lb. per hour, which was still better showing as you will note, so we feel entirely justified in saying that the blower has made good with us and is proving a very material saving."

IN PRACTICAL ENGINEER for June, in the description of the Merchants Heat & Light Co. power plant at Indianapolis, the fact was unintentionally omitted that the station is equipped with a complete oiling system and that 2 of the latest Improved Unit Type oil filters made by the Burt Mfg. Co., of Akron, Ohio, are installed in the plant.

TO MEASURE the length of a belt in a roll, add to the diameter of the roll in inches the diameter of the hole in the center of the roll. Multiply this sum by the number of coils in the roll and multiply the product by 1.32. The 3 figures on the left represent the number of feet in the roll.

THERE CAN BE no sweet without some sweat.—System.

PRACTICAL ENGINEER CLASSIFIED ADVERTISEMENTS

Advertisements in this section are inserted under regular headings at the rates of 40 cents per line. About nine words make a line. No display type allowed, but the first three words may be set in capital letters. Minimum space sold, two lines.

Under classification, "Positions Wanted," advertisements not exceeding four lines will be inserted for subscribers once free of charge.

To insure proper classification, copy must reach this office on or before the 20th of month preceding publication.

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POSITION WANTED—Young man experienced in construction and maintenance, hoisting, conveying and handling machinery, desires permanent connection or erecting work. Good labor handler. Sober. References. Address Box 169, Practical Engineer, Chicago, Ill. 7-1

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